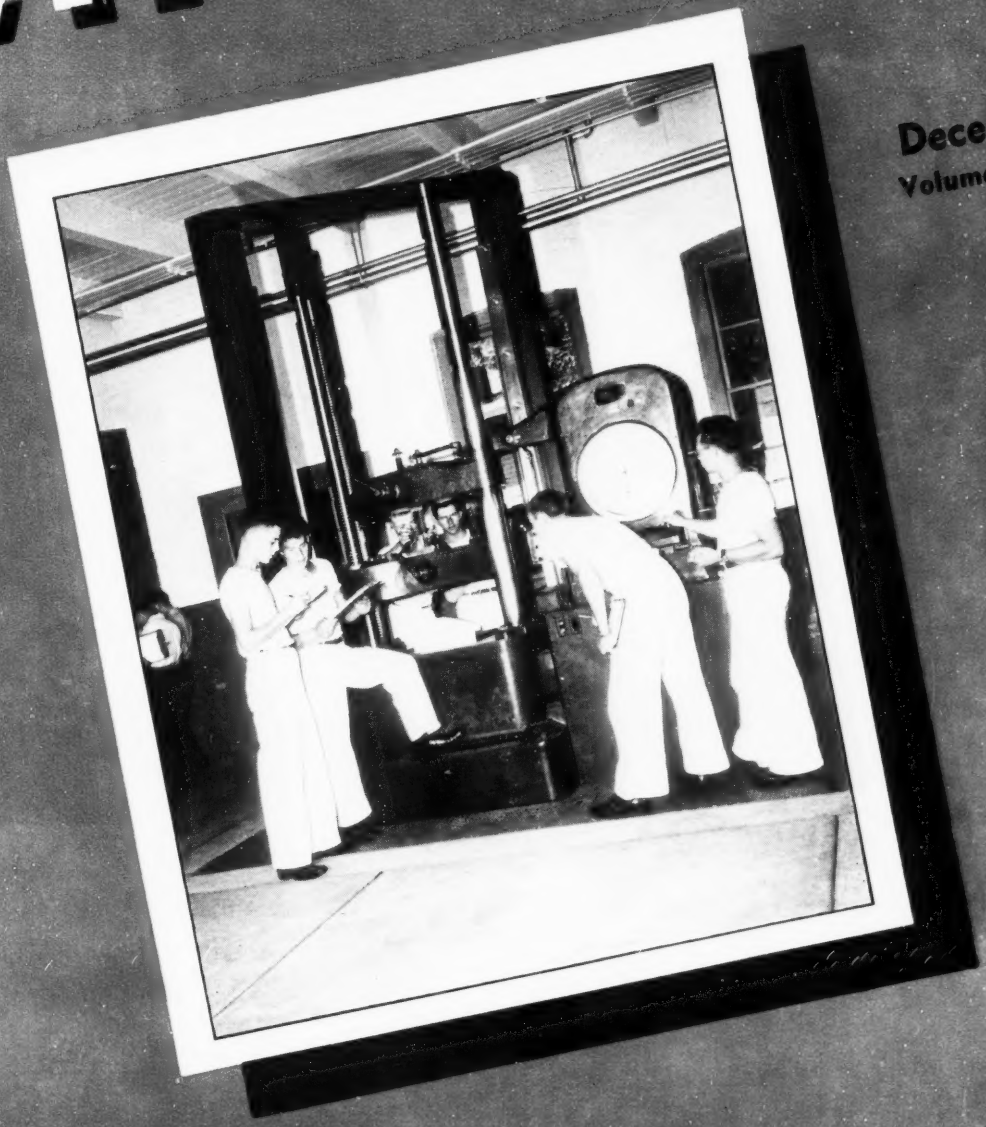
THE CORNELL ENGINEER



December, 1943
Volume 9—Number 3

COLLEGE OF ENGINEERING • CORNELL UNIVERSITY

WAR

has exploded the German chemical myth

This is the Chemical Age and many people believe that Germany is *the* chemical nation. Yet history shows that the synthetic organic chemical industry really started in England, got much of its early impetus in France and has reached its greatest development right here in America.

Germany undoubtedly contributed vast research . . . and vast propaganda . . . but she made the mistake of trying to make it a German monopoly, through Government subsidies and control. There is a profound lesson for us in that.

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The CORNELL ENGINEER

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Cover: V-12 students testing steel bar in Mechanical Laboratory
—U. S. Navy Photo

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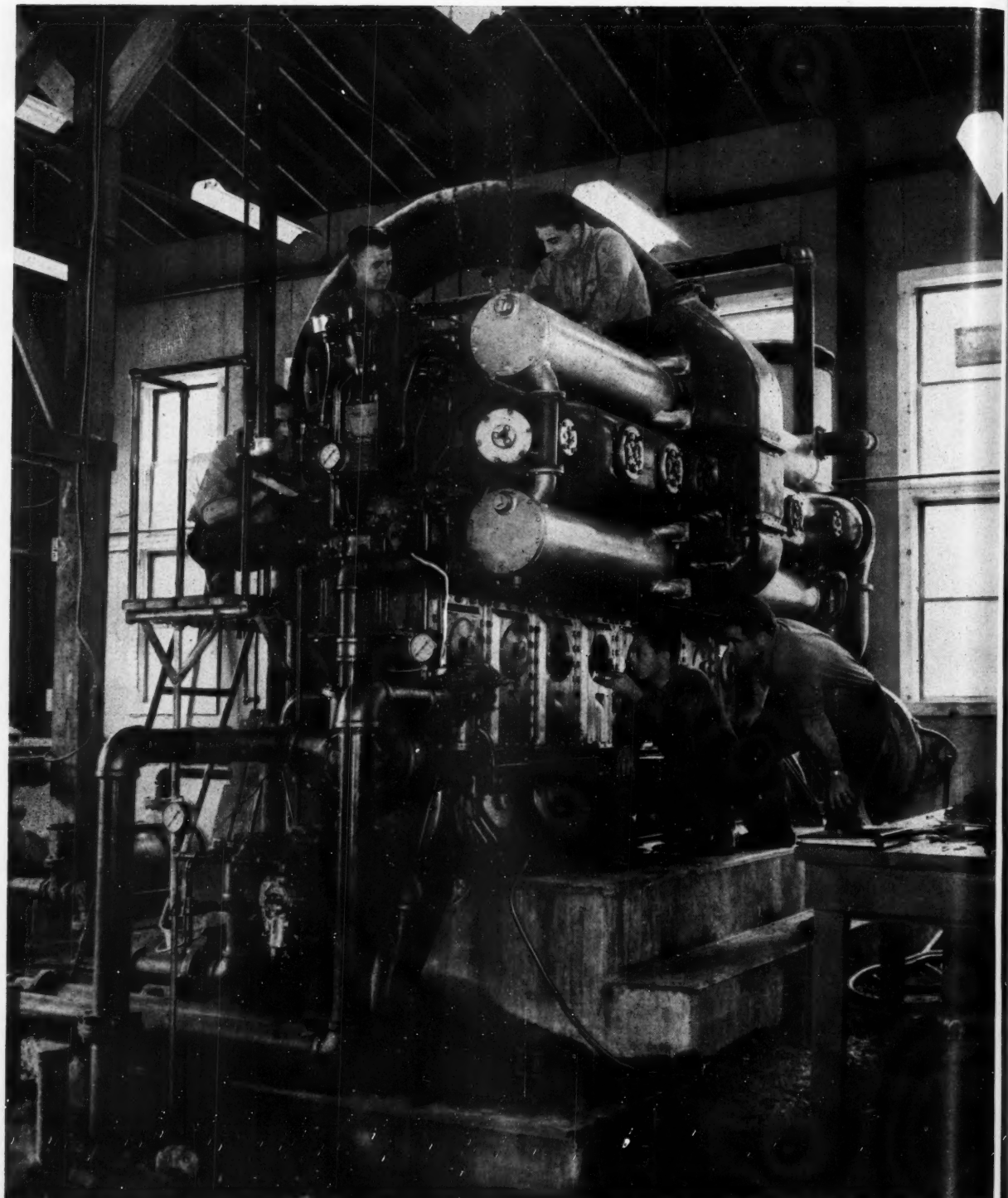

U. S. Navy Photo—Alumni New

This 15 ton Hamilton Diesel Engine provides practical instruction to the Navy students in the newly enlarged Diesel Engineering Laboratory.

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The effect of the Naval Training Program on the College of Engineering.

Cornell and the V-12 Program

By HERBERT H. WILLIAMS, JR., C.E. '26

Assistant to the Dean of the College of Engineering

THE Navy V-12 Program has been in operation at Cornell University since July 1st, 1943. Slightly more than one thousand of the apprentice-seamen trainees on the campus are assigned to the College of Engineering. The first V-12 term in the College has been completed, and it is now possible to say something regarding the nature of the program and its effect on the teaching and administration of the College.

Although the V-12 program has received enough publicity so that most are familiar in a general way with its purpose and the methods by which trainees are selected, a brief review of some points will be of interest. The apprentice-seamen assigned to engineering are of two general groups. First is the group coming into the program directly from secondary schools. These men have been chosen from among the large number who took the qualifying test given last April. This test is used by both the Army and the Navy for the selection of students qualified by scholastic ability for participation in the training programs of the respective Services. V-12 trainees entering directly from secondary schools pursue specific curricula laid out by the Navy in various fields of engineering. These curricula cover eight sixteen-week terms of engineering studies. They include courses for men being trained in civil engineering, construction corps, mechanical-steam, mechanical-internal combustion engines, electrical-power, electrical-communication and pre-radar, aeronautical-engine and aeronautical-structures.

The second group are men coming into the program with one or more terms of college behind them. They may have been in either the V-1 or V-7 reserve classification or may have been selected as a result of taking the V-12 examination mentioned above. These men, as transfer students, are instructed by the Navy to continue, insofar as possible at Cornell, the courses of study upon which they have already embarked. Aside from satisfying certain minimum requirements of interest to the Navy, they are able to pursue our regular civilian programs in chemical, civil, electrical, and mechanical engineering. The transfer student group constituted about two-thirds of the eleven hundred who were assigned as engineers in July. They also constituted a tremendous problem in registration and schedule planning for the two days allotted to that purpose.

It was necessary to consult at length with each transfer student, evaluate the courses and credits from his previous college (one of the thirty-seven represented here) to develop a plan of study for him. Engineering curricula in the various institutions from which students were drawn differ widely. The task of fitting these men into the pattern of our own courses of study was very great indeed.

Not until the two days of registration when all this individual scheduling was done was it possible to determine even approximately the number of men who would be taking work at a given level, nor what individual courses need be taught and to how many. Room and staff assignments had to be made almost over-night, as the distribution of students throughout the college was not by any means a normal distribution.

1048 V-12's Entered

When the air had cleared somewhat and assignments were completed, tabulations indicated a Navy freshman class of 367, of whom 306 were first term men taking the fully prescribed Navy curriculum common to all prospective engineers for the first two terms. There were in addition 336 sophomores, 222 juniors, and 123 seniors. Almost all above the freshman level were so-called irregular students, not able to fit completely into the Cornell curriculum at the level they had reached in their previous institutions because of curriculum differences. Generally speaking, these differences resulted in the main from the fact that the Cornell engineering curricula are based on the completion of mathematics through integral calculus, and of a year of physics and chemistry during the freshman year, whereas many engineering colleges do not demand completion of these basic subjects at such an early stage.

A thorough study of the curricula of the engineering colleges represented was made with the purpose of revising somewhat the

degree requirements in the College of Engineering at Cornell. As a result, the degrees of Bachelor of Science in Chemical, Civil, Electrical, and Mechanical Engineering were set up. These new degrees may be attained by many of our transfer V-12 students while some are so prepared that they may receive the degrees of Bachelor of Civil, Electrical, or Mechanical Engineering which are normally given. Some students who were transferred to Cornell in their seventh or eighth term will undoubtedly be able to get degrees from their former colleges by submitting transcripts of work completed at Cornell.

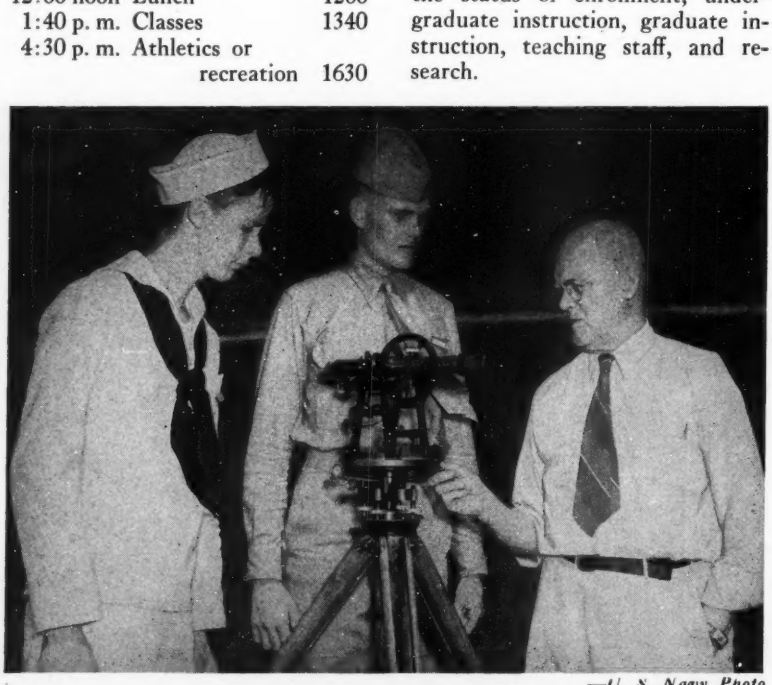
The normal day of a V-12 student is somewhat as follows:

Civil Time	*Navy Time*
5:50 a.m. Reveille	0550
6:45 a. m. Breakfast	0645
8:00 a. m. Classes	0800
12:00 noon Lunch	1200
1:40 p. m. Classes	1340
4:30 p. m. Athletics or recreation	1630
6:00 p. m. Dinner	1800
8:00 p. m. Study period	2000
11:00 p. m. Lights out	2300

The schedule is a full one, and hours available for study are limited. For the first few weeks, during which students were adjusting themselves to military discipline and closely regulated schedules, many had difficulty in finding the time they felt necessary for the preparation of their classroom assignments. The greater part of this difficulty was unquestionably due to their inexperience in carefully budgeting available time. This complaint almost disappeared as the term drew to a close.

Attendance at all scheduled classes is required by the Navy. All latenesses and absences from class are reported daily and, if not incurred in line of duty or because of sickness, result in prompt discipline of the individual concerned. As a result absence from class has been largely eliminated.

Has the College of Engineering been changed by the V-12 program and by the war? If so, in what respects? These are questions of interest to alumni of the College, and to parents of students and prospective students. They may be answered by discussing briefly the status of enrollment, undergraduate instruction, graduate instruction, teaching staff, and research.



—U. S. Navy Photo

Professor Leonard A. Lawrence, Surveying, explains the workings of a transit to Apprentice Seaman A. L. Whinston, USNR, and Private T. S. Whiting, USMCR.

Civillian Enrollment

The enrollment in the College of Engineering is close to the maximum capacity with the present staff and facilities. Of the approximately 1700 students currently enrolled, about one-third are civilians. The civilians are either under draft age or are deferred by the War Manpower Commission through Selective Service as being in training for essential civilian occupations.

Undergraduate instruction is available to civilians in the branches of engineering normally taught at Cornell. Senior elective courses are of necessity restricted in some fields due to the heavy demands upon faculty members, but in all essential characteristics the normal peacetime curricula will continue to be offered, though on an accelerated, three-term-a-year basis. V-12 and civilian students intermingle in classes and are held to the same standards of academic accomplishment which existed before the war. The Navy has specifically requested that these standards be maintained. Civilian students realize they are in college because of the desire of the War Manpower Commission to maintain a flow of competent engineers into essential war industries. They are treating their studies with the seriousness of purpose appropriate to their part in the war effort, and the College itself understands its duty to train as civilian engineers only those who demonstrate their ability to serve as such.

Little Graduate Work

Graduate instruction is largely curtailed. The armed forces are returning very few men for graduate work, and the demands of industry are of such an immediate nature that almost all civilian engineers are required for such service as they can render at the bachelor's degree level.

The staff of the College is larger than in normal times and almost without exception is carrying a teaching load well above that necessary or desirable in peacetime. Besides a near-capacity enrollment of undergraduates, instruction is provided for the Diesel and Steam engineering student-officers assigned to Cornell, for about one hundred Curtiss-Wright Cadettes, and for a wide offering of Engineering Science Management War Training courses given in Ithaca, Auburn, Elmira, Corning, Buffalo and elsewhere. Nine thousand persons in industry have received training during the past year through the ESMWT courses.

With the staff so busy, few graduate students, and necessary war restrictions on materials, the re-

(*Continued on page* 32)

Why Centrifugal Refinery Pumps Are Different

By IRVING TAYLOR, M.E. '34

Pump Engineer, The Lummus Company

Irving Taylor

THERE are only about six manufacturers in the United States who build a complete line of centrifugal pumps designed for refinery services. Yet there are at least ten times that many manufacturers of water pumps and general service pumps, not including the several makers of small centrifugal pumps for the chemical field. Many of the general service pump manufacturers have indicated a desire to compete in the refinery pump business at one time or another, but with the exception of one or two who were able to augment their incomplete line of refinery centrifugals with large size plunger-type reciprocating pumps, very few have made the grade. Without a complete line they can hardly hope for large orders, since the oil refining companies and the designer-builders quite often prefer to obtain all centrifugals for a new unit from one manufacturer, to save on overhead and maintenance.

By the term "refinery services" is meant not only those pump applications in all the many types of oil refinery, but also the pumping duties in plants which refine hydrocarbons to make ingredients such as butadiene and styrene for synthetic rubber. Of coure the refinery field and the chemical plant field are coming to overlap, eliminating any sharp line of distinction, so that a manufacturer of refinery pumps may need to include a good centrifugal chemical pump in his line from now on. Besides centrifugal pumps, a complete line of all refinery pumps would include reciprocating pumps (both piston and plunger types, either direct-acting steam driven or power driven through cranks and gears), plus a few rotary pumps, turbine type pumps, propeller pumps, and perhaps an occasional diaphragm pump. However, since the centrifugal pump can fulfill most of the refinery duties as well as or better than the reciprocating pump, it has come to be foremost from the refiner's point of view.

THE AUTHOR

After graduating from Cornell in 1934, Irving Taylor went "on test" with the General Electric Co., beginning with commutator bar-to-bar tests on motors which now drive the Pennsylvania Railroad's locomotives. After several other test assignments, including a year's testing of steam turbines, he took a place in the expanding business of refinery design and construction.

He spent 2 years at the M. W. Kellogg Co. as an assistant mechanical engineer. Since 1939 he has been Pump Engineer at the Lummus Co., part of this time having been spent at manufacturer's shops and in the field.

Mr. Taylor is active in the Metropolitan Section of the American Society of Mechanical Engineers.

Why are centrifugal *refinery* pumps different? Because the duties are more severe than for most other pump applications. Higher pressures, higher temperatures, lighter specific gravities, low values of NPSH (net positive suction head, over the vapor pressure of liquid being handled), and variable combinations of these conditions are concomitant in the modern refinery. "Suction" pressures, or the pressures on the upstream side of the pumps, are often 450 psi. or higher; discharge pressures on heater charge pumps may be as high as 2100 psi.; corresponding differential pressures converted to feet of total head can sometimes be as high as 8500 feet because the liquid may be only half as heavy as water; pumping temperatures up to 800°F are not uncommon. For variable conditions a typical case might be that of a pump which usually is required to handle a hot liquid of low specific gravity against a certain head, within a range between "normal" and "design" capacities, but which also must occasionally handle a much heavier oil, cold, against a lower head at even greater than the hot "design" capacity. This latter operation will quite likely require more horsepower than the former, which is one of the reasons why the motor-drivers cannot often be chosen for the HP corresponding to the "design" duty-point on the predicted performance curve. It is usually necessary to size a motor driver considerably in excess of this duty-point horsepower, to allow for overcapacities and changes in specific gravity.

Then how must refinery pumps differ so as to meet these duties which are more severe? Refinery centrifugal pump units differ in (1) general construction, (2) materials, (3) special features, including cooling and sealing features, cooling

and sealing auxiliaries, precautionary arrangements to maintain continuous operation, and precautionary arrangements to safeguard personnel.

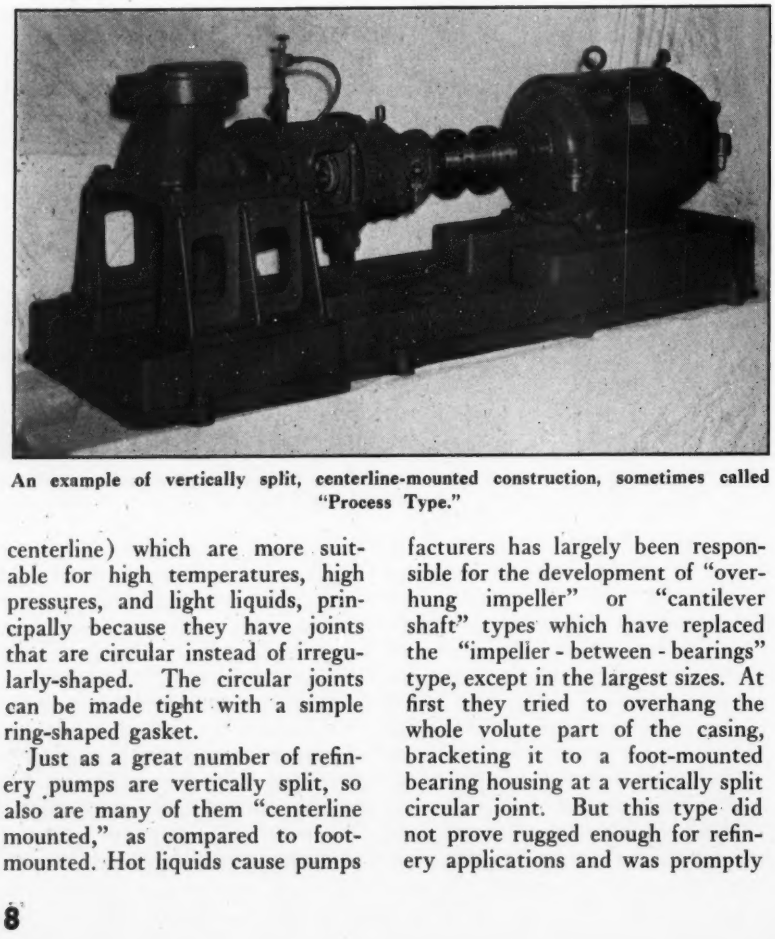
General Construction

Construction differences begin with the general shape. Each manufacturer of refinery centrifugals has several distinct types, and several sizes in each type. Since the designation or name of a type is not the same from one manufacturer to another, it is necessary to distinguish the various types by (a) the kind of split joint, (b) the manner of support or mounting, and (c) the relative positions of the volutes, nozzles (connections) and bearings.

For horizontal pumps (horizontal shafts) we differentiate between those with horizontally split casings and those which are vertically split Perhaps if we used the terms "longitudinally split" and "perpendicularly split" they would apply equally well to vertical shaft pumps. Refinery applications require many vertically split casings (the split being perpendicular to the shaft centerline) which are more suitable for high temperatures, high pressures, and light liquids, principally because they have joints that are circular instead of irregularly-shaped. The circular joints can be made tight with a simple ring-shaped gasket.

Just as a great number of refinery pumps are vertically split, so also are many of them "centerline mounted," as compared to foot-mounted. Hot liquids cause pumps to expand. To eliminate misalignment between pump and driver resulting from the expansion, (for even the so-called "flexible" couplings dislike misalignment) it is the practice to position the support lugs on hot pumps at the sides near the horizontal centerline, where they can be bolted down onto pedestals rising from the baseplate. The pedestals, which are sometimes water-cooled, do not become very hot and their vertical expansion is negligible. Therefore the height of the shaft does not increase with temperature rise as it would on a hot foot-supported pump, because the hot parts of the pump expand away from (both up and down) the fixed centerline. All but the smallest sizes of steam turbine drivers are centerline-mounted for the same reason.

Until recently most all single-stage and two-stage refinery centrifugals had a bearing on either side of the volute part of the casing; i.e., the impellers were positioned on the shaft *between* the bearings, the same as on longer multi-stage pumps. Competition between manufacturers has largely been responsible for the development of "overhung impeller" or "cantilever shaft" types which have replaced the "impeller - between - bearings" type, except in the largest sizes. At first they tried to overhang the whole volute part of the casing, bracketing it to a foot-mounted bearing housing at a vertically split circular joint. But this type did not prove rugged enough for refinery applications and was promptly superseded by a type having an overhung impeller but not an overhung volute. When the volute itself is supported, (either by pedestals or feet, depending on temperature) and the impeller is overhung inside the volute from a bracket-mounted bearing housing, the pump is much more able to resist any misaligning forces caused by abnormal pipestrain. This construction is called a "process type" by some of the manufacturers, reflecting the fact that this type was designed almost specifically for duty in refinery processes as distinguished from general utility services.



An example of vertically split, centerline-mounted construction, sometimes called "Process Type."

Multi-stage Types

Besides the many types of single-stage and two-stage pumps, there are several multi-stage designs which take care of the higher pressure services. Here again the vertically split, centerline-mounted construction is more often selected if the liquid to be handled is hot, or of very low specific gravity, or both. Some manufacturers prefer to face all the impellers toward one end of the pump, particularly if diffusors are used instead of volutes, and provide a hydraulic thrust-balancing device at the high pressure end to relieve the load on the thrust bearing. Other makers of multi-stage pumps arrange some of the impellers to face one end and some to face the opposite end, including cross-over passages between certain stages, so that axial thrust is substantially eliminated without need of any balancing device. But it will not be necessary to go into the relative merits of the diffusor type as compared to the volute type, since pumps of both designs perform very well.

Since high mechanical efficiency is of less importance than reliability in refineries, clearances between the rotating parts and the stationary case bushings are sometimes made a trifle wider in multistage refinery pumps than in boilerfeeders to minimize chances of internal rubbing. This might be considered as another construction "difference."

When the capacity to be delivered happens to be small (say 100 gallons per minute or less) and the required pressure is so high as to necessitate many stages, it has been found expedient to build the

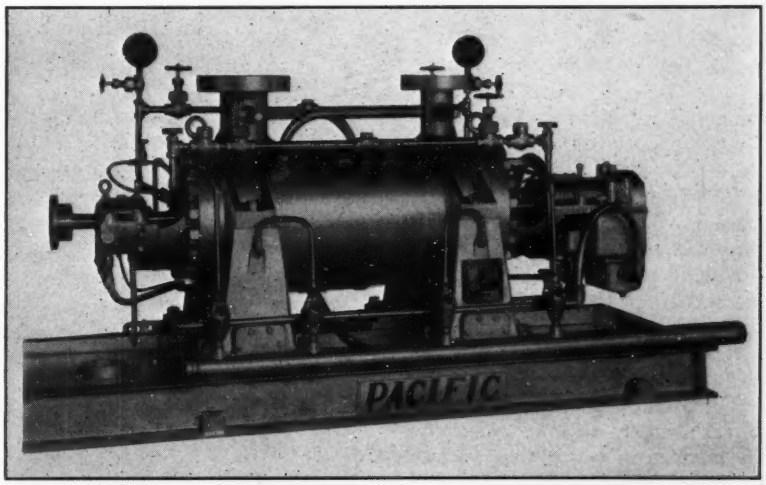
pump with a vertical shaft rather than a horizontal one. This construction facilitates guidance of the long thin shaft with its many impellers, because the internal bearings are not subject to any gravitational load in the vertical pump. Any thrust that is not eliminated by an opposed arrangement of impellers is carried by the thrust bearing in the driver.

Materials

Pump casings must be able to withstand the stresses due to maximum anticipated pressures and temperatures with a sufficient factor of safety. To make sure that they will stand the pressures, it is a standard requirement that after the machining is done the casings be subjected to a hydrostatic test, using water at twice the anticipated discharge pressure. But the choice between cast iron and cast steel, or between cast steel and forged steel, as a case material must be governed by considerations of both temperature and pressure. (Other materials such as bronze or alloy iron are used too, but strength is not likely to be the governing factor in their selection.) A chart could be included in the specifications of a refining or refinery-contracting company to delineate the desired dividing lines between ranges of temperature at various pressures for iron, steel, and forged steel. However, unless considerable corrosion is expected, it is probably better to allow the pump manufacturers to offer whichever material they recommend, making sure that they know all the pumping conditions to be met. They will have to guarantee the pumps for a year against everything except corrosion and improper operation in any event. Should there be corrosive liquids to be pumped, it is likely that ¼" extra casing thickness will be required over and above the minimum for strength.

It might be stated here that forged steel casings are almost always selected for horizontal hot-oil centrifugal pumps if the pumping temperature exceeds 600°F and the pressure requires more than three stages. Frequently the inside of these forged steel cylindrical case-barrels is partially or completely lined with a welded layer of stainless steel. This prevents corrosion; it also facilitates removal of the internal assembly which is likely to become surrounded by coke formed from the stagnant oil between the assembly and the case. All forged barrels should be stress-relieved after welding on the nozzles, support lugs, and the lining.

Materials of the internal parts of refinery centrifugal pumps often must be either alloy iron or stainless steel for resisting corrosion, nickel and chromium being the important alloying elements. Parts which might wear or rub against each other must be hardened, but not both to the same degree of hardness. A difference of at least 50 points Brinell is necessary to prevent galling, which would increase the likelihood of a seizure or "freezing" of the pump.



This high pressure, multi-stage hot oil centrifugal pump is vertically and centerline mounted. The pump is furnished with cooling and sealing piping manifolds. The boltholes in the support lugs on the outboard pedestals are elongated to permit the barrel to expand lengthwise.

Special Features

Refinery pumps often appear to be surrounded by a maze of small size auxiliary piping, complete with valves, gauges, pressure regulators, visual flow indicators, and sometimes thermometers. One part of this assortment includes the water cooling manifolds which distribute water to and from all the jackets built into the unit for cooling the packing boxes, base pedestals, radial bearings, thrust bearing; also to and from the oil cooler on large size high pressure pumps. The rate of water flow needed for each pump unit may be anywhere from 2 GPM on a small, cold oil, single stage pump, to 35 GPM on a large, high pressure, hot oil pump.

The other part of the auxiliary piping consists of manifolds for gland oil or seal oil, and sometimes injection (flushing) oil, or else bleed-off lines, all having to do with prevention of leakage. To explain the need for any of these auxiliaries it is well to describe the various methods of solving the packing problem on refinery centrifugal pumps.

Most pump packing boxes are arranged to prevent leakage by the compression of stationary rings of material (packing) which rub on the rotating shaft. If the liquid being pumped happens to be a lubricant and is not too hot or injurious to packing, the problem is solved without need of any auxiliary equipment. But very often the liquid is not itself a good lubricant, so that it becomes necessary to supply a small amount of any available lubricating oil to the middle of the packing box, where there is a lantern ring or lantern "gland" (corresponding to a water seal-cage on a general service pump). This seal oil or "gland oil" may be fed from a mechanical lubricator, or circulated by an auxiliary pump at low pressure, or it may be taken directly from a process line as a side-stream, distributed through the lantern rings, and returned to some other process line or vessel. Frequently however, the packing problem is even more difficult, such that lantern ring lubrication alone is not a satisfactory solution. A typical

(*Continued on page* 34)

Mine Surveying

By RICHARD S. LANDSMAN, CE '46

THAT branch of surveying which is specially applied to the measuring of works beneath the surface of the earth is called "mine surveying." It consists of measuring the workings of a mine with a view to the production of plans and sections. Special surveys may be carried out, the object of these being to enable the mining engineer to determine the relative position of points which are inaccessible to each other, and to determine the manner in which these points are to be connected. Also, he may find it necessary to make measurements which will enable him to draw up plans of operation.

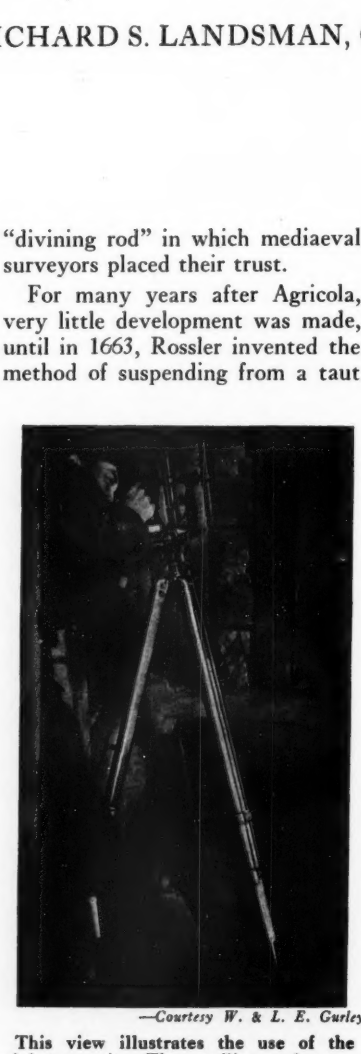
In underground surveying, the operations being confined to a narrow space, the methods and instruments used are necessarily different from those used in surface surveying.

History

The evolution of mine surveying instruments makes an interesting story by itself. Instruments for measuring the dimensions of mines have been in use from earliest times. The records of Hero of Alexandria, who lived in the second century B.C., contain descriptions of a triangular sighting instrument, which he invented and called a "diopter".

Not many records of early instruments were made in the first centuries of the Christian era because, for the most part, anyone who had any engineering skill at all kept it a closely guarded secret. However, in 1556, a person named Agricola wrote a treatise on mining in which an entire chapter deals with mine surveying. The main instrument of the time was the "divining rod" in which mediaeval surveyors placed their trust.

For many years after Agricola, very little development was made, until in 1663, Rossler invented the method of suspending from a taut hempen cord a gimbal compass and clinometer by which the magnetic bearing, inclination, and length of any line were determined fairly easily.



—Courtesy W. & L. E. Gurley

This view illustrates the use of the mining transit. The auxiliary telescope on this instrument is mounted on the side rather than the top.

Over the years, the cord gave way to a chain, an alidade was added, and gradually the instruments were improved.

At the turn of the nineteenth century, the plane table came into use, about the same time as the theodolite was being developed.

From that time on, various improvements were added, such as better lenses, verniers, etc., until the modern instruments of today emerged.

Measuring Lengths

In many mines it is advantageous to use a 300-foot tape for measuring distances, since the distances between mine stations usually are less than this length. This fact removes the problem of marking tape lengths in the mine, which is a laborious and timestaking task.

Today, most angles are measured by means of a mining transit although the ordinary transit is also extensively used.

The difference between the mining and regular transit is that the mining transit has an auxiliary telescope on it. This is used for reading vertical angles down the steep slopes which are frequently found in mines.

In measuring lines underground, some modifications must be made in the methods used at the surface. For instance, pins cannot be set in the mine floor since it usually is too hard. Therefore, marks are made with chalk to signify a tape's length.

In important surveys, great care must be taken to assure that straight lines are measured from station to station. Thus, when marking, two lines are drawn, one in the line of the tape and the other at right angles to it so that the intersection shows the exact ending of the tape.

Angle Measurement

The instrument most commonly

used in the past in mine surveying was the miner's dial. In its simplest form, it consisted of a circular box with a scale of degrees ranging from 0 to 360 on its base. A brass ring was fitted inside the box. This ring was divided into quadrants, which were themselves divided into degrees. A magnetic needle was placed in the center. The box also had sights on it, which were in line with the zero mark on the dial. Two levels were fitted on the instrument at right angles to each other. The whole box was mounted on a tripod.

There are five methods used in reading horizontal angles; by circle bearing, by quadrant bearing, by direct reading, by deflection angles, and by repetition.

In measuring angles by circle bearing, the angle read is the one between the magnetic needle and the reference line. It is always read in a clock-wise direction.

In measuring by quadrant bearing, the angle described above is placed in one of the four quadrants and read in a clock-wise direction also.

When using direct readings, the instrument is first sighted on one point with the vernier at zero. The vertical axis is then clamped, the vernier unclamped and turned to the other point. The angle formed by this movement is then read.

Using deflection angles, the supplementary angle of the direct reading is taken.

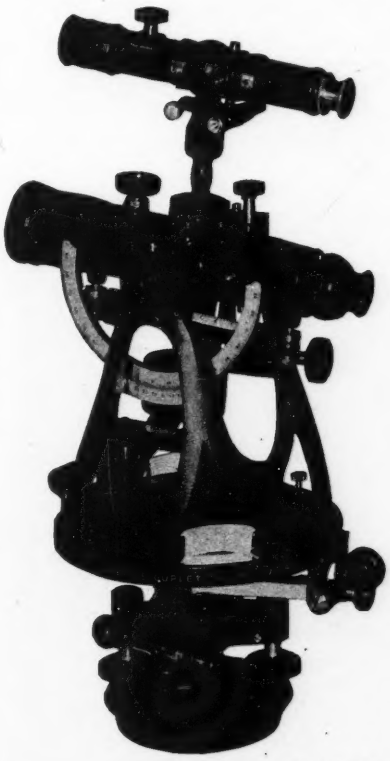
Measuring angles by repetition is used only where great accuracy is needed. This method consists of measuring the angles several times and taking the average reading.

Of the various branches of mine surveying, the most important is the plotting of the survey. Unless this is done properly, the management of the mine with regard to the plan of operations may be impeded.

In the early days of mining, it was the custom to lay out on the surface lines that had previously been surveyed underground in order to determine relative positions of surface features. Even nowadays this method is sometimes used. However, most modern surveys are plotted out on paper by the means of the coordinate system.

Beside the general mine plan, several other plans must be drawn up. These include ventilation plans, which show the principle devices for regulation and distribution of air; the rescue brigade plans, which beside showing tracings of the mine workings themselves, must also include location of all shafts and telephone stations; and electrical plans which show positions of all apparatus.

In order that the finished plans be complete, all details such as



—Courtesy W. & L. E. Gurley

The mining transit differs from an ordinary transit chiefly in that an auxiliary telescope permits sighting down a very steep grade.

faults, air-shafts, stoppings, pumps, engines, and machines must be located by measurement. Direction of air currents, and the nature and thickness of the floor and roof are also noted.

Leveling

Another important branch of underground surveying is leveling. Either the dumpy or wye level is used and they are set up exactly as on the surface.

There are three methods of leveling ordinarily used for underground work, the choice of methods depending upon the slope of the ground.

First, the level and staff may be used as on the surface except that the sights will be much shorter, since a mine usually has fairly steep grades. However, this method isn't practical where too steep a grade exists as too many shots must be taken.

Another method that can be used is known as trigonometrical leveling. When the inclined distance is known and the grade observed, the difference in elevation can easily be determined by use of mathmatical formulas. The mining transit is generally used for this task. The accuracy obtainable by this method is fairly low in comparison with leveling as done by the first one, but accurate enough results are attainable if a reasonable amount of care is taken.

The ordinary mechanic's level can be used for approximate leveling over distances from five to ten feet. This level consists of a sensitive bubble in the center of a straight edged piece of wood. When the bubble is centered, the vertical distance under it to the ground is measured. This method is frequently used in grading underground haulage roads and is a fairly satisfactory means of leveling.

Correlation With Surface Surveys

It is very important that the underground workings of any mine be in the correct position relative to surface features. Serious accidents and many legal squabbles have occurred through faulty correlation of surface and underground plans. For these reasons it is imperative that surface surveys be run down unhindered into the mine itself.

If the mine has an inclined shaft, the traverse may be transferred into the mine by ordinary surveying methods. However, if the mine has a vertical shaft, a system involving the use of plumb bobs is necessary. In certain cases, the use of plumb bobs causes inaccuracies because plumb lines are to a certain extent subject to the whims of air currents. On the other hand, a traverse transferred into a certain mine with two vertical shafts six miles apart by means of plumb lines had only one foot of error in subsequent surveys run between the shafts.

Most of the difficulties which are

(*Continued on page* 32)

"Loose Juice"

Collected by Bob Garmezy

THE LOWDOWN ON WHITE

WHAT the Hell is an architect, anyway? As one of our close associates told Prof. Lawrence after a surveying final, "That's a good question, Shorty." The story goes that when God made all the people that were to inhabit the earth, one day He ran out of people to make. He was tired after His great task, having just polished off the last batch of M.E.'s, and He had just time enough left to create one more walk of life. Well, God said, "We'll run off one more bunch and name them later." When He had finished with them, He took one look at the funny looking creatures and said, "They look so silly. We shall call them architects." And since the beginning of time the word "architect" has been used as the nomenclature pertaining to that class of dim-witted creatures of which a clan is to be found in our very midst. These individuals, with which the rest of the University has very little if anything to do, reside in a reclaimed Army camp known as White Hall.

We wonder if the reader has ever been in the architects' section of White. We wondered what smelled so bad that year we took calculus there—we didn't know that the architects' school was just upstairs. The calculus department is the architects' main source of undergraduate personnel. After every calculus prelim you will find architects outside the classrooms trying to lure poor, befuddled frosh away from the staid, wholesome courses of the College of Engineering. Some of the weaker ones give in to the flowery pictures painted by these atrocious beings; but once a frosh is caught in the upper environs of White, there is no escape. The architects' school pervades the body and soul like dope. It will eat the very heart out of a normal man leaving him a mere hulk of the person he was formerly. We have seen it happen.

There was one delightful fellow of our acquaintance who, through some trickery on the part of a crafty architect, was lured into the entrails of White Hall. Now, a year later, he is a hopeless mental wreck. He spends his time in his padded cell cutting out paper dolls. On each one he scrawls the word, "father", followed by what might be interpreted as almost anything, but on close examination seems to be "John." Then he takes a pair of pruning shears and gleefully snips off all the heads, blubbering all the while, unintelligibly.

Would God that we did not even have to associate with them; but for our sacred charter we would not. But when Ezra Cornell founded the University, he fixed it so that "any person can find instruction in any study." Yes, that even means architects. Tough.

—*Eddie Lannom,* CE '46

* * *

THE LITTLE CREATURES

IT is an interesting world in which we live. The scientist can watch his little bugs have no end of fun under a microscope. (I often wonder if they would do what they do if they knew that people were watching them.) The chemist can pour all sorts of things together and do amazing things and they derive a great deal of enjoyment thereby. And it is in much the same spirit that the architect watches his neighbor, the C.E., across the campus playing with his bridges and his roads much as mama watches junior with his first set of Tinker-Toys.

Now the architect really doesn't care one way or the other about the C.E. After all, there are a great many things in life that just exist and nothing much can be done about it. They serve some function as do all of God's creatures. So it is with the C.E. From an architects point of view, Lincoln Hall and its inhabitants are very much like an ant hill full of ants. Industrious little creatures, they run and romp all day and act very busy and provide a great deal of amusement for all intelligent onlooker.

Every now and then the architect who has been laboring over some important problem in building design sits down by his window and looks out over the quadrangle to see what the Little Creatures are doing. Quite often they are looking through little holes in long sticks. This instrument they call a tripod. What they accomplish by all this is very dubious; but if it makes them happy, why stand in the way of this humble pleasure. It is generally believed among the architects that this is a game they play. The rules are a little vague, but they go something like this. Each player is given one of the sticks. Then they look through the holes until they see another player. When they do, they wave their hands in a signal which means, "Peek-a-boo, I see you," and jot this down on the score board they carry. Then each of the contestants sticks a peg in the ground as his marker and runs a wire between the two pegs. By doing this, one of the other players looking through his stick is apt to trip over the wire, kill himself, and thus be eliminated from the game. It continues like this until there are only two players left at which time they fight it out to the finish.

What they do inside Lincoln, the architect is not quite sure, but from what is seen of them on the outside, it is generally assumed that they have numerous games that can be played indoors.

Every once and a while, while romping on the quadrangle, they see the architects laughing and resent it, for even they are supplied with a crude system of emotions that react much the same as those of a normal human being. This is also an interesting procedure. On such occasions they all band together and challenge the architects

(*Continued on page* 32)

NEWS OF THE COLLEGE

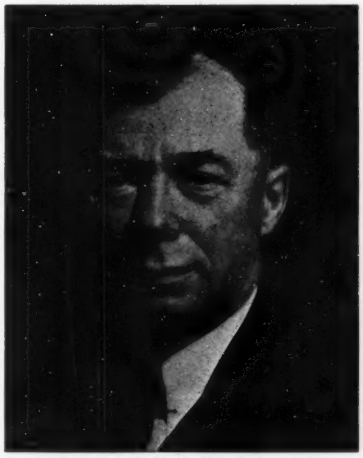
Frozen-Food Study

THE School of Nutrition at Cornell, in collaboration with the College of Engineering, Home Economics, and the State Experiment Station at Geneva, is engaged in an extensive study of the processing and storing of foods and of the frozen-food locker plant industry of the country. The aim is to aid its development in the East, particularly New York State if, as is expected, the need and interest call for it. Funds for the work have been made available by the Consolidated Edison Co. of New York.

A committee of eight at Cornell is studying all phases of the frozen food industry, especially locker plants in which more and more families throughout the country are storing their supplies of meats, fruits, and vegetables in frozen form. Locker plants, it is felt, can afford a means of preserving much of the surplus foodstuffs raised in Victory gardens or by farmers for their families, and to date their development has been carried on with benefit of much study of scientific planning.

Committee members were chosen from different departments of the University because of their special interests or abilities. Dr. Frederick S. Erdman, assistant professor of mechanical engineering, is chairman, and works on engineering aspects of locker plants. Other members are Mrs. Nancy K. Masterman, home economics, who will continue her study of home freezer units and start another on patron preferences; Miss Arlene Nuttall, home economics, to study bookkeeping systems in relation to locker plants; Dr. Helen Canon, home economics, to coordinate the work of the committee with that of the College of Home Economics; Dr. Willis A. Gortner, School of Nutrition, to study the effects of processing and freezing on the nutritive values of foods, their appearance and palatability; Dr. F. H. Rhodes, director of the School of Chemical Engineering, to deal with freezing rates and their effects on the condition and palatability of meats.

Also, Dr. F. A. Lee of the Geneva Experiment Station, is to work on methods of preparing foods, such as fruits and vegetables, for freezing; and Prof. W. M. Curtiss, agriculture, will collaborate with a committee recently appointed by



Dr. F. H. Rhodes

the New York State Frozen Food Locker Association on proposed legislation for locker plants in this state.

Chief aim of the Cornell committee is to prepare general plans and specifications for frozen-food locker plants, including the best-known features and omitting undesirable ones. Several of the committee members have traveled extensively to inspect installations now in operation in the west. Mrs. Masterman has been to California and Texas, and both Erdman and Curtiss attended, in September, the Des Moines convention of the National Frozen Food Locker Association. Erdman also made trips this summer to study plants in 7 mid-west and southern states as well as in New Jersey, Pennsylvania, and New York.

Systems of bookkeeping suitable for individual locker plants and large central plants with branches will be developed, as well as a starting inventory to guide operators of new plants. Results of the studies will be announced as the different phases are completed, and in time, it is hoped, to aid the anticipated development. The committee is prepared to help persons or groups interested in the industry, and New York state county agricultural, home demonstration, and 4-H club agents have all been informed of the project.

Diesel Lab Developments

THE completion of a new wing of the Diesel Engineering Laboratory brings to nearly 9,000 square feet the total floor space in the entire laboratory, built by the University for the Navy at a cost of approximately $50,000. This new wing will house small auxiliary engines used on Navy craft.

The laboratory is equipped with virtually every kind of Diesel engine used on Navy vessels, representing an investment of more than $2,000,000. In the main section are six 30,000 pound giant engines used to power large ships. All are mounted on concrete blocks seven or eight feet thick, and an overhead trolley in the main wing carries chain hoists which are used in tearing down and reassembling the engines.

Tanks and piping are installed for fuel supply and for the compressed air used to start the large engines of the types used on submarines and other naval vessels. West of the laboratory building is a cistern holding 30,000 gallons of water to provide the 2,000 gallons a minute needed for cooling the engines.

Near the Old Armory a former heating plant has been fitted out with all kinds of Navy auxiliary engineering and electrical equipment, including pumps, searchlights, boilers, refrigerating ma-

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Tau Beta Pi Essays

A man elected to Tau Beta Pi, national engineering honorary society, is required as one of his pledge duties to write a short essay on a non-technical subject.

The CORNELL ENGINEER *takes pleasure in publishing this month two essays from those submitted during the last few years. Two more will be published next month.*

These papers have one characteristic in common. All of them illustrate the fact that an outstanding engineer, in addition to technical proficiency, needs a breadth of interest extending into other fields. He must be able to find satisfaction in pursuits outside the boundaries of his profession if he is to become a truly well-balanced man.

THE LASTING PEACE

By George Swallow, ME '43

THE lasting peace, the peace we are all working for, striving for, fighting for, is a peace which must be planned now, and executed with an unselfishness, an understanding, and a love of our enemies such as has never before been seen by this world. It calls for a bold and honest declaration of principles of a character beyond those proposed by even the most benevolent figures in our political scene. It calls for belief and action in the everlasting truths shown us by the Christian religion.

These truths point to an ultimate goal of a World Brotherhood of man. Translated into political terms this cannot help but imply a form of world order which has as its objective the well being of all peoples and races; one which does not introduce false barriers of national pride, racial prejudice, or class hatreds. In short, it is an order not only directly opposed to the form of government we are fighting against, but differs greatly from the government and political ideology for which we are fighting.

Our politicians and citizens call on us daily to stop Hitler, to anihilate the Jap menace, but so few go beyond this. They tactily imply, as most of the others vociferously declare, that we shall free the world in order that it may enjoy our kind of government, at least those who are on our side shall enjoy it. The fate of the enemy is either unmentioned or unmentionable.

We cannot, nor can any one else, win a permanent peace on the basis of self-interest and revenge. Much has been said concerning the inevitability of an ultimate victory for the United Nations because the Axis doctrines are contrary to the fundamental principles of human nature. This logic is strictly negative and fails to recognize that both sides can be the ultimate losers if neither of them is identified with the cause which is on the side of this principle of human nature.

For this reason it is imperative that we as a nation fully realize the necessity of fighting a battle which has as its goal the greatest good for all men. We cannot, then, fight for the kind of peace that the merchants of hate would have, or a peace such as the status quo group desires, a return to the old national traditions of pride, arrogance and self-attainment with no regard for the rest of the people of the world other than to keep them "in their place".

We must, if we are to enjoy a final, enduring peace, be prepared to aid the vanquished rather than crush them. We must set up the machinery by which all of us shall be assured that the world shall be run to better advantage for its inhabitants than it has in the past. These plans, this machinery, must be clear cut and dynamic.

Attempts at understanding and agreement with other nations concerning post war policy have been made in such documents as the Atlantic Charter. Plans such as that of Congressman Jerry Voorhis have been proposed by various politicians. However, none of these gets at the heart of the problem. They are superficial and incomplete. They merely restate the battle cries of the last war and propose a second try at the kind of world collaboration which failed so miserably.

It is high time the world realize that power balances, leagues, threats and economic sanctions cannot constitute a successful control on the affairs and wellbeing of men and nations. It is time we realize that the forces which create war stem from nationalism and that nationalism and the many barriers that go with it are completely artificial.

The world has reached the time when world wide government, not collaboration of existing governments, is possible, and if war is to cease, essential. We must, if the world is to continue to improve, advance our political thinking to the point where it is compatible with our scientific and technological advances. Ox cart politics are simply unsuited for an airplane civilization.

It is, then, our duty and obligation to our fellow citizens and to the citizens of the world to recognize these truths of humanity and government and to attempt to promote what must be, in order that we may know, not "peace in our time," but peace for all time.

CROSS-COUNTRY MEET

By Frank Moore, ME '44

THERE is a hestitant flurry of snow in the air, and the late November's wind is driving and chill. The ground is damp with last week's rains, however, and there are puddles of ice water in the low places. These things I note as I trudge to the field house. All day I have been tight-lipped and silent; there is an unsettled, nervous feeling in the pit of my stomach. Is it nervous anticipation, or is it animal fear? I don't know.

I open the door of the locker room, and I catch the pungent odor of wintergreen rubbing oil. I associate its perfume with other days such as this, and a feeling akin to seasickness sweeps over me. I go to my locker, and a teammate makes a mournful crack about the weather. We both grin wanly and begin the routine of preparation; rubdown; into the red and white

(*Continued on page* 20)

ALUMNI NEWS

Cornellians Speak At ASME Convention

Among the speakers at the annual meeting of the American Society of Mechanical Engineers held in New York from November 29 to December 4 were Dexter S. Kimball, Dean Emeritus, College of Engineering, and John R. Bangs, M.E. '21, recently Professor of Administrative Engineering and now a general manager of the Budd Manufacturing Company.

"However well-intentioned efforts to restore industry to civilian production may be, their success will be, in no small degree, affected by the attitude of the Federal Government," said Dean Kimball. "We shall emerge from the war with the Federal Government owning outright a number of large plants and much industrial machinery and with what amounts to a mortgage on much more industrial equipment. Will these holdings be turned over to private enterprise, or will the government take this occasion to extend its competition with private enterprise?

"Many industrial plants have been converted to the production of war equipment vastly different from that for which they were designed originally. Will the owners of these plants be left with sufficient funds to reconvert to peacetime products, or will Federal taxes, as it now seems probable, leave them stripped bare of assets necessary for this much desired change?

"These and similar questions must be answered before management can see its way into the future."

Professor Bangs said that plans must be made now by the managements of individual companies throughout the land to achieve a level of production and consumption after the war estimated at from 35% to 40% above that of 1940. Only by doing so can it provide enough jobs to give employment to a group of people of from seven to eight millions higher than any previous normal period. These twin objectives of high-level production end high-level employment may be achieved by the utilization

John R. Bangs

of all technological improvements that can be profitably used, by the expansion of production of each company through the development of new products and the improvement of old products, and by reducing the cost of production and distribution to stimulate a foreign and domestic demand.

"In meeting the challenge of the postwar period, management must continue to concentrate on the legislative bodies of Congress to get provision for adequate reserves in either the new revenue act or the amended renegotiations act. Such reserves are the key to reconversion of plants to peace-time production. Similarly, management must prepare now for war contract cancellation and the necessary inventory adjustments that go with the cessation of hostilities. Frozen inventories, such as happened in 1921, could spell disaster for postwar employment. Management must formulate its postwar relationships with respect to its employees. Labor has well enunciated postwar plans of its own, and management's job is to make certain it has equally good or better plans."

"E" Awards

The Benrus Watch Co. of Waterbury, Connecticut was awarded the Army-Navy burgee for outstanding production of time fuse and anti-aircraft fuse components and other precision instruments. Benjamin Ozaroff '22 is the general manager of the company.

The David Bell Co., Inc., of Buffalo, manufacturing automatic screw machine products, won the "E" award November 2. William J. Dugan '07, former Graduate Manager of Athletics and Secretary of the University, is vice-president of the company.

The Mid-West Forging & Manufacturing Co. of Chicago, Illinois, has been awarded the Army-Navy "E" for its work in forgings for armor-piercing projectiles. Jay L. Hench '07 is president of the company.

Consolidated Engineering Co., Inc. of Baltimore, Maryland, has won the Army-Navy production award for its work in the Naval Air Station, Cedar Point, Md. John A. Stalfort '10 is president of the company and his son H. Al-

(*Continued on page 26*)

Cornell University Placement Service

WILLARD STRAIGHT HALL, ITHACA 107 E. 48th ST., NEW YORK CITY

PROMINENT

Howie Parker

Howard Parker, ChemE

An athlete of no little ability, an excellent student, and an all-around fellow—these descriptions all fit Howard Parker, fifth year Chem E. It seems almost incredible that one person could find the time to do all the things he has done. Sports, societies, and working his way in addition to the tough Chem. E. course—he takes them all in his stride.

One varsity sport is enough to keep most athletes pretty busy, but not so Howard. He has played five years of varsity baseball, and, save for a severe knee injury, would be playing his fifth year of varsity basketball this season.

Howard is treasurer of Al Djebar and secretary of Retort and Beaker, both Chemical Engineering societies, and is also a member of the A. I. Chem. E. Recently, he was elected to membership in Tau Beta Pi, the engineering honor society. However, his activities are not all connected with engineering. Howard has been on the Men's Cabinet of the C.U.R.W. and for three years was a counselor at Frosh Camp. In his last year he was Director of the camp.

This term he began instructing in mathematics for six hours every week. He has been working ever since he came to Cornell. This, along with the McMullen Regional Scholarship he was awarded, has made him almost self-sustaining.

As for the future, Howard expects to get a position in industry, preferably in his native South, where he won't have to weather the icy blasts which he has had to endure for the past four winters here in Ithaca.

John Parrett, ME

Cornell owes a great deal to that certain alumni who gave John Parrett the idea of coming to Cornell from St. Joseph, Michigan, for he has made a real place for himself while he has been here. Since he is in his last term in the Navy V-12 unit, he will leave in February, with an outstanding undergraduate record.

His father being a consulting mechanical engineer, and he himself having mechanical inclinations, Johnny arrived at Cornell with a McMullen Regional Scholarship under his arm, and entered the M.E. school. He then proceeded to start his college career off with a bang, gaining his numerals in basketball and frosh baseball and getting on the Dean's List in his freshman year. Since then he has left neither the Dean's List nor the basketball team, and has branched out from there. As a freshman he joined his fraternity, Sigma Alpha Epsilon.

During his sophomore year he worked on the board of the Cornell Almanac, a University calendar, then in its last year of publication. He also was a member of the Sophomore Smoker Ticket Committee. In both his sophomore and junior years Johnny pulled down his JV letters in basketball, playing right guard with the Big Red hoopsters. Other sports besides basketball have interested him, as he was active in interfraternity sports whenever basketball didn't interfere and was also a member of the Rugby Club last spring. As an ME he became interested in internal combustion engines, and during his junior year he was taking some aeronautical engineering options until he became an apprentice seaman.

Because of his record in scholarships, sports, and extracurricular activities, Johnny was elected to Red Key and Atmos in his junior year, becoming Vice-president of Atmos in his senior year. He was elected president of his fraternity in the spring of his junior year. As a senior he was elected to Tau Beta Pi, becoming treasurer of that organization last spring. He was also elected to Sphinx Head.

Sailing is one of Johnny's favorite recreations, though he hasn't done any here at Cornell; he owns a Star class boat out on Lake Michigan. During his last vacation he spent two weeks cruising around the lake before he reported for duty in the V-12 program. Johnny was also a "ham" while back in high school in Michigan, and still possesses a license to operate an amateur station though it is void for the duration of the war.

Johnny furthered his mechanical engineering education in his summer vacations, working for the Nineteen Hundred Corporation in his home town of St. Joseph. He was employed one summer as a turret lathe operator and another summer as a tool designer.

He enlisted in the Navy V-7 program in Buffalo in the fall of 1942, as he wanted to be sure to get in the Navy because of his hobby of sailing. This summer he was ordered back to Cornell to continue his studies in the V-12 program, and

Johnny Parrett

since that time has been a well-liked resident of Dorm 17. He says that although he thinks that the V-12 program is really good, he doesn't like to see Cornell changed by the Navy.

After the war Johnny wants to come back to Cornell for a term or two to take up some courses which he has not been able to take in the Navy program, and also to be able to get some "real college life." After that, though he likes Naval Architecture on the side, Johnny would prefer to get some administrative engineering job. Until that time, however, he is setting his sights on a PT boat (he hopes), or, if that is impossible, a destroyer.

Richard Milhan, CE

After finishing one year of work in the University of Colorado, Richard Milhan came to Cornell in the fall of 1942 as a Civil Engineering student. His main reason for transferring is simple. Both his father and brother, though hailing from Pueblo, Colorado, are Cornell graduates, and Dick wanted to continue in the family line.

Although he didn't participate in many extracurricular activities while at Colorado University, he has made quite an impressive record for himself here. Besides being secretary-treasurer of Chi Epsilon, CE honor society, he is the secretary of the ASCE, chairman of the Civil Engineering Honor Committee, and associate editor of the *Transit*.

In addition to these offices, he is a member of Tau Beta Pi, honorary engineering society, is a proud possessor of a four year McMullen scholarship, and has made the Dean's List twice.

Taking advantage of the accelerated program started in 1942, Dick has continued to study straight through except for the five week vacation last spring. For four out of those five weeks he held a job in the Colorado Fuel and Iron Company, working mostly in one of the iron mills. During the break between attending Colorado University and Cornell, Dick worked in the South Colorado Power Company.

Right now Dick is trying to get into the "CB's", Construction Battalion of the U. S. Navy, as a civil engineer. After the war Dick's choice of occupation is that of a structural engineer in a steel mill, preferably doing some sort of outdoor work.

Dick Milhan

Milton Stolaroff, EE

There are few people on the campus today who have not heard the name of Milton Stolaroff, president of the Student Council. To mention just a few of his many activities, he is president of Eta Kappa Nu, electrical engineering honorary society, and secretary of Tau Beta Pi, honorary engineering society. In CURW he is chairman of the Men's Cabinet and secretary of the Student Board. In addition he belongs to the Delta Club, EE social society, the American Institute of Electrical Engineers, and a number of other organizations and committees too numerous even for him to keep tab on without his little note book.

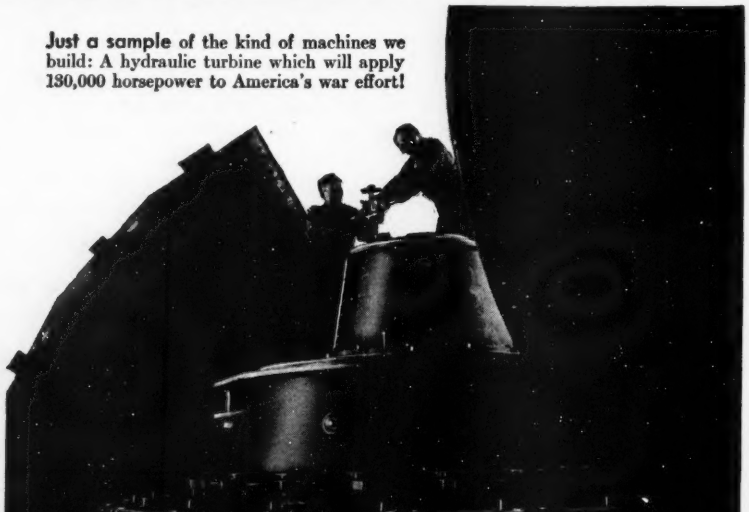
Yet in spite of all this extra load, which would be enough to keep a couple of people busy full time, Milt has certainly done very well in school. He holds a John McMullen Regional Scholarship and has been on the Dean's List every term. It was winning the scholarship which brought him 2,200 miles to Cornell from his home town, Roswell, New Mexico. According to Milt, Roswell is the greatest little town on earth, and he stoutly denies as a purely malicious rumor that the town has recently been raided by a tribe of Apaches on the warpath. Apparently the Indians have been scared off by the big mechanical birds that now nest in Roswell at the newly constructed Army Air Base there.

Milt Stolaroff

Milt feels a personal interest in this Air Base because during the last two summers he helped to build it. He worked as what is technically known as an Assistant Engineering Aide, but he claims that the job included everything from drafting to expediting. This last job he enjoyed especially well, since he delighted in talking long-distance to executives of big-name companies to tell them just how they were holding up the war effort by failing to deliver on time.

This work gave Milt valuable experience, although it is not exactly the kind of work he plans to do later on. Were it not for the war, he would have liked to stay for some graduate work and perhaps a few years of teaching. After graduation he intends to either work with his brother—also an electrical engineer—doing development work for the Government, or to gain some practical experience in private industry.

Just a sample of the kind of machines we build: A hydraulic turbine which will apply 130,000 horsepower to America's war effort!



Powe the

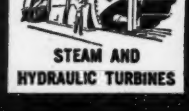
TWO BIG JOBS! And Allis-Chalme ate the tremen helping do both. This unusual comp A-C motors, d makes 1600 industrial products—every on flowing . . . from equipment that helps make and st ces equipmen steel and aluminum for U. S. airplane moving precio giant turbines for U. S. power plants. 1600 different

THAT SUPER CARGO PLANE is like om this one co thing out of the future. You didn't gineers are hel pect to see it for years. Yet there it is anufacturers w machines—

America's great industries are cram It's a tremend years of aviation advancement into mo almers men a And Allis-Chalmers is working at top ence that can m to help them produce more and better pl tter peacetime

Huge Allis-Chalmers turbines help LLIS-CHALMERS M

ELECTRICAL EQUIPMENT


STEAM AND HYDRAULIC TURBINES

MOTORS & TEXROPE V-BELT DRIVES

BLOWERS AND COMPRESSORS

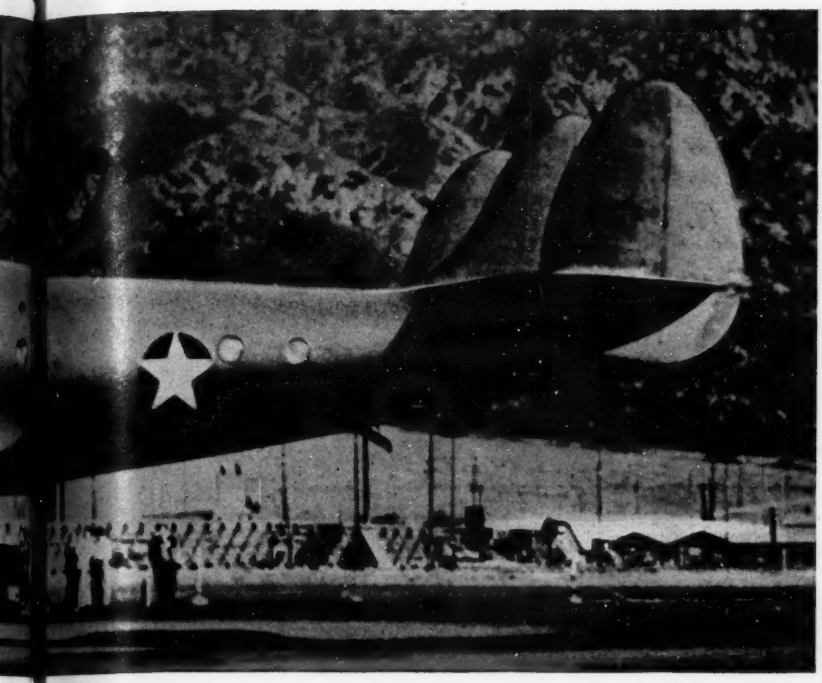
ENGINES AND CONDENSERS

CENTRIFUGA PUMPS

UR AND SAW L EQUIPMENT

ALLIS-CHA

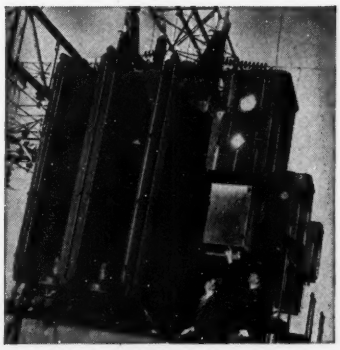
SUPPLYING THE WORLD'S LARGEST LI MAJOR



the Nation!

ate the tremendous electric power needed. A-C motors, drives, controls keep production flowing . . . and Allis-Chalmers also produces equipment for making aluminum and removing precious magnesium from the sea. 1600 different industrial products come from this one company. And Allis-Chalmers engineers are helping plane makers and other manufacturers *produce more*, not just with new machines—but with *machines on hand!* It's a tremendous job—and out of it Allis-Chalmers men and women are gaining experience that can mean better peacetime planes, better peacetime goods of all kinds.

ALLIS-CHALMERS MFG. COMPANY, MILWAUKEE, WIS.



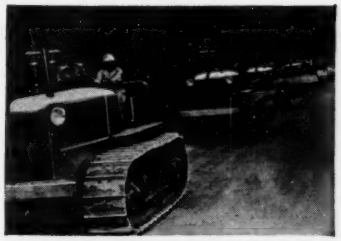
One of many Allis-Chalmers transformers that help transmit vital electrical power to U. S. war plants.

VICTORY NEWS

A-C Maintenance Booklets Now In Spanish, Portuguese! More than 200,000 Allis-Chalmers booklets on wartime maintenance of motors, pumps and rubber V-belts have been requested by men in industry whose job it is to keep machines running.

So great a demand has also come from South American countries that these booklets are now being printed in Spanish and Portuguese.

They are packed with practical information which is particularly helpful in training new men for the important job of making motors, pumps and rubber V-belts last longer during this critical war period. Write for your copies (English, Spanish or Portuguese) today.



Good Neighbors get together! The picture above shows Allis-Chalmers equipment ready for an important road-building job near Rio de Janeiro.

A-C Aids Ship-Building Program: America's shipyards have already smashed every ship-building record in the book—and production of merchantmen and warships is still climbing.

A-C is one of the companies which is feeding these yards. It supplies a larger variety of equipment for ships than any other company in the U.S.A.

Belts, blowers, castings, condensers, control devices, generators, motors, turbines, rudders, complete hull sections, transformers, pumps are just a *few* of the items which we are supplying.

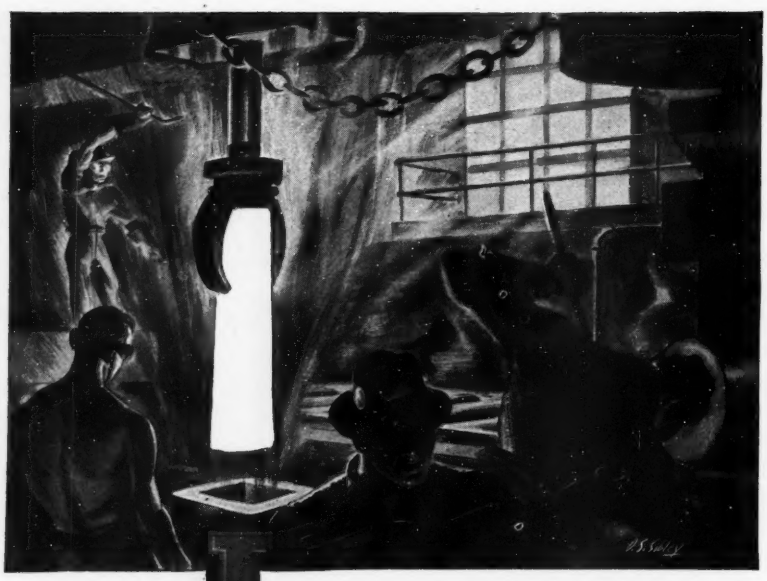
FOR VICTORY
Buy United States War Bonds

CHEMICAL PROCESS EQUIPMENT
CRUSHING, CEMENT & MINING MACHINERY
BOILER FEED WATER SERVICE
POWER FARMING MACHINERY
INDUSTRIAL TRACTORS & ROAD MACHINERY

ALMERS

MAJOR INDUSTRIAL EQUIPMENT

WE WORK FOR VICTORY — WE PLAN FOR PEACE



INGOTS GO TO WAR!

THE HARRISBURG STEEL CORPORATION produces thousands of tons of carbon and alloy steel each year, practically all of which is now used in the manufacture of materials of war for the Armed Forces of America and her Allies.

From Harrisburg's modern open-hearth furnaces, carefully controlled heats of molten steel are carried to the pits by huge ladles that pour it into giant molds. These molds form the ingots of precious steel . . . steel that is now "going to war" but will be used to make Harrisburg's famous Seamless and Drop-Forged Steel Products.

To make these quality products the steel itself must be right.

That is why Harrisburg makes its own carbon, alloy and special steels. That is why Harrisburg products are right from the start . . . supervision begins at the open-hearth and ends only at the point of shipment.

Today Harrisburg sends its Steel Ingots to War but when Victory is ours these same ingots will again be used in the manufacture of peacetime products . . . products that have been sold in the markets of the world for over ninety years.

HARRISBURG MAKES: Alloy and Carbon Steel Billets, Seamless Steel Cylinders, Liquefiers, Pipe Couplings and Pump Liners, Hollow and Drop Forgings; Pipe Flanges.

Buy Bonds for Bombs and Bombers

HARRISBURG STEEL CORPORATION
HARRISBURG · PENNSYLVANIA

LETTERS TO THE EDITOR

Nov. 29, 1943

Editor, The Cornell Engineer:

Did you not have a composing slip in your Nov. 1943 issue? Should not Mr. J. J. Brown's article on "Is American Ingenuity Going to Waste" have appeared under "Stress and Strain"? Now what big bad American Industry in connivance with the "iniquitous patent laws" cheated this poor inventor out of his world-saving brainchild? I believe you need some more chemists and chemical engineers on your editorial staff. Watch out for this fiction writing by English instructors.

Yours for facts,
F. W. SCHUMACHER, '30
Westfield, N. J.

* * *

Editor, the Cornell Engineer:

Dec. 3, 1943

Kindly send me a copy of the November, 1943, issue of the CORNELL ENGINEER . . . The article by Prof. J. J. Brown has aroused my interest. There is in a Senate sub-committee a bill (#S. 702) which if passed might overcome the difficulties cited by Prof. Brown. Write to Senator Kilgore for more information on the bill called "Scientific and Technical Mobilization . . . "

Yours truly,
JOHN E. SHULTS, E.E. '26
Elmhurst, Long Island, N. Y.

The CORNELL ENGINEER *invites further correspondence from its readers on this as well as any other topic.*

Tau Beta Pi Essays

(*Continued from page* 14)

uniform; "Hey, George—pin my number on my back, and I'll pin yours"; I'd better tie a double knot in those shoelaces; then into the sweatsuit and down on the mat for a rest. I watch the clock—15 minutes to go. I hear the coach's quiet, measured explanation of the strategy to be followed in the race. I listen, although it's no concern

(*Continued on page* 22)

Figures *Can* Lie

$$4 = 9 - 5$$
$$4 + 25/4 = 9 - 5 + 25/4$$
$$4 - 10 + 25/4 = 9 - 15 + 25/4$$
$$(2 - 5/2)^2 = (3 - 5/2)^2$$
$$2 - 5/2 = 3 - 5/2$$

Therefore $2 = 3$

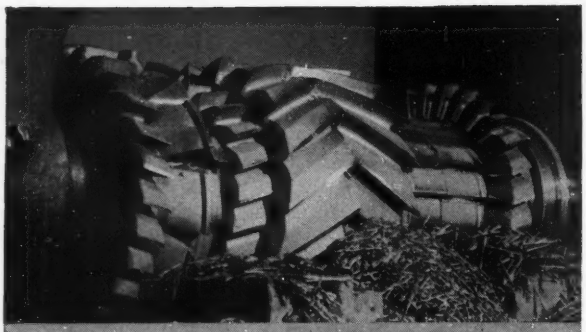
SAFEGUARDING "HOME FRONT" LINES!

TELEPHONE lines from poles to homes take a terrific beating from old man weather. And with wire for replacements drafted for military use, existing lines must be kept in good condition.

Asphalt coating applied in time keeps out moisture, chief trouble maker on telephone lines. Without lowering the wires, this trolley painter speeds the coating—helps recondition 50 lines a day.

This simple "stitch in time" helps keep communications open to the homes of America—and saves critical materials for vital war weapons.

War calls keep Long Distance lines busy . . . That's why your call may be delayed.



Cutters Give You More Production When You Give Them More Care

Make cutters last longer and serve better by correct handling and sharpening as well as by proper care in operation.

Cutters are scarce these days — they need extra care so that the production requirements for our armed forces can be maintained.

BROWN & SHARPE CUTTERS

CHRISTMAS CARDS

Cornell Winter Scenes
Currier & Ives ***American Artist***
Army, Navy & Marine Cards

Our Co-op Printing Service will imprint your name on the cards which you select.
Quick Service — Reasonable Prices

The Cornell Calendar for 1944
$1.50

THE CORNELL CO-OP
Barnes Hall Ithaca, N. Y.

Tau Beta Pi Essays

(*Continued from page* 20)

of mine; I'll run myself blind and perhaps finish tenth in the field.

The zero hour! My mind is torpid, but my body feels weak and agitated. "Last call, Varsity, let's go!" We tumble out of the locker room, and jog up to the track, where the starting line awaits.

"Everybody ready? Line up!" Off with the sweat clothes. The cold, whipping wind seems to freeze the oil on my legs. I have a feeling of tiredness and inadequacy as I stand there, shivering and very much alone.

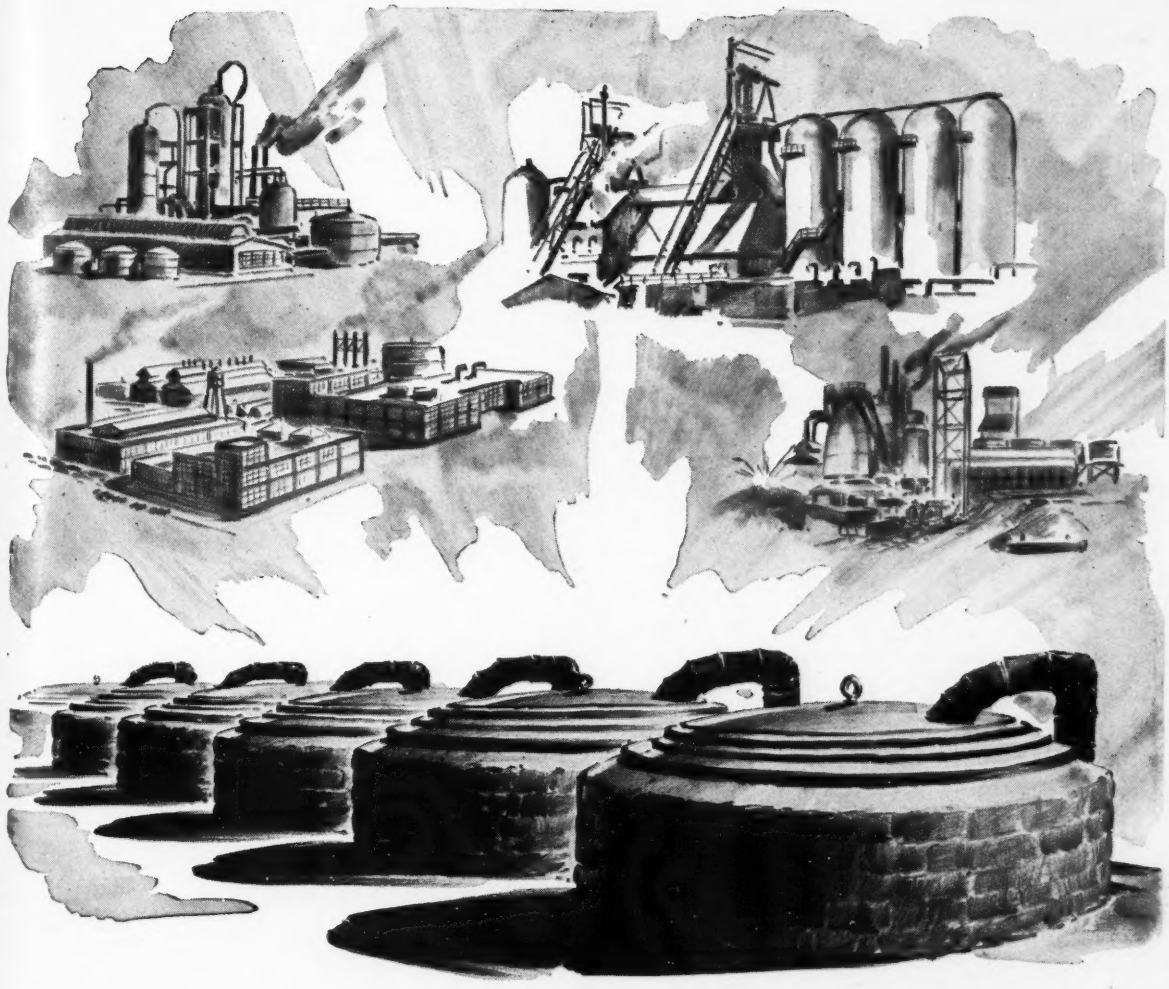
"Go!" The field whirls down the track. My brain clears; I am conscious of no effort; I seem to glide rather than to run. We reach the first hill, and the vicious pace begins to tell—already the leaders are well ahead of me. I grind up the hill; I reach the top with my lungs sucking in quick, labored draughts of air so cold it seems to burn. My legs are numb and weak—I fervently wish I were out of this. The first exhaustion soon wears off, but the race continues. After an interminable time the two-mile marker is reached. Three miles to go! Perhaps I'll quit. I'll never make the finish anyway. Who'd give a damn if I stopped? It wouldn't hurt the team. No—I'll go a little farther; I've felt as tired as this before and had lots of running left in me. The race becomes a bad dream; I pound along through icy slush, over rolling, foot-bruising stones, along hard pavement that seems malignantly to be trying to shatter my ankles. I pass a teammate—we murmur phrases of mutual encouragement. I pass a runner of the rival team; he fights hard, but he is farther gone than I am. Every step is an agony of exhaustion, but the end of the race is nearing and the primitive desire to subdue an enemy comes to the fore.

The fierce excitement exceeds the pain, and I try desperately to catch the man ahead of me, looking over my shoulder to see how far I lead those inexorable footsteps creeping up behind me. We reach the last quarter mile. I run with long, digging strides. My legs go numb —time hangs motionless. I seem a distinterested observer; all pain is gone.

The last hundred yards! I open the last reservoir of energy and sprint madly—the track and the runners reel in a gray haze before my eyes.

The race is over. I find myself standing drunkenly with my hands on my hips, covered with oil and sweat, trying to spit. I can't—my mouth feels as if it were filled with flour paste. Someone helps me into my sweat suit, and I wobble toward the locker room, feeling relieved and happy in spite of weariness, aching muscles and bloody blisters on my feet.

I feel a pride, not in achievement, because I came in tenth, just as I had expected, but in the strength and guts lodged in my small body. True, I came in tenth out of twenty, but to do that I had to run at the pace of a briskly pedaled bicycle. Why should I punish myself so sadistically? Perhaps because man instinctively knows that he may best serve his self-respect and ego by setting himself a cruel task which his fellow mortal will decline, and which will command his respect if achieved.



CAUSTIC SODA—a key chemical in industrial growth

Caustic Soda is an indispensable chemical needed by industry in huge quantities. A long list of products—notably petroleum, soap, paper and textiles—use it as an essential material in various manufacturing processes. The production and availability of this hard-working chemical are consequently of genuine importance.

Following the course dictated by its own initiative, Dow began many years ago to specialize, step by step, in the chemistry of brine. Original methods for the production of bromine led to chlorine, and the process for making chlorine produced caustic soda as a co-product. During the intervening years, Dow has become one of the leading producers of this key chemical, with plants so strategically located that they are prepared to serve the entire nation.

This development is cited merely to emphasize the importance of self-reliant enterprise.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

New York • Cleveland • Chicago • St. Louis • Houston • San Francisco • Los Angeles • Seattle

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

College News

(*Continued from page* 13)

chine, evaporators, and an air compressor, while in Olin Hall the Navy has engine subassemblies and fuel injection equipment as well as classrooms.

Cornell has been training Naval officers for duty as engineer officers on Diesel-propelled vessels since March 31, 1941, and several hundred officers have already completed the course. All teaching and equipment was at first centered in the College of Engineering, but expansion was soon necessary. The new Laboratory was started in October, 1942, and completed toward the end of the year. The new wing was started last May.

The Navy Department now owns and supplies all equipment and shares instruction with the University. Captain B. W. Chippendale is commanding officer of the Naval Training School, Lieut. Comdr. Norman R. Sparks directs the Diesel engineering program for the Navy, and Professors H. N. Fairchild and Harry J. Loberg are respectively in charge of instruction and administration for the College of Engineering.

Eta Kappa Nu

BECAUSE of the good scholastic standing of its members, its participation in most of the regularly accepted activities of college chapters, and particularly because of its outstanding achievements in 1942, the Cornell (Kappa) chapter of Eta Kappa Nu was awarded a plaque by the New York alumni chapter.

In that year, the members of the chapter searched over the campus, cleaned, brought together in one place and catalogued all the relics of the early history of electrical engineering — thus establishing a museum of inestimable value. In this museum, among other pieces, will be found the original Morse telegraph instrument and some of the first machines of Dr. Molar and Dr. Bedell, as well as interesting apparatus made by Westinghouse for demonstration purposes during the well-remembered case of A. C. vs. D. C. involving General Electric.

Kappa chapter now enjoys the enviable position of being the only chapter to date to win this award twice—also having been cited in 1935-36.

AIEE

A joint meeting of the Ithaca and student branches of the American Institute of Electrical Engineers was held recently in Franklin Hall. W. W. Lewis of General Electric spoke on "Lightning and Abnormal Line Conditions". At another meeting, Mr. Edward Mug, a former industrialist now with the Navy program here at Cornell, spoke on his practical experiences during fifty years of electrical engineering.

Eta Kappa Nu provided the program at the Student Branch A.I.E.E. meeting, Dec. 3. Several professors gave short talks on interesting experiences they have had. The highlight of the evening was a quiz contest between teams of three faculty members and three students, the students winning by a score of 88 to 60.

Cadettes Graduate

GRADUATION exercises for the Curtiss Wright Cadettes were held Tuesday evening, December 14, in Olin Hall. The ninety-six cadettes who received certificates for the completion of their ten month's

(*Continued on page* 28)

LAVA

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•

GRAPHITE CRUCIBLES
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HIGH-TEMPERATURE CEMENTS
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LAVA CRUCIBLE COMPANY of
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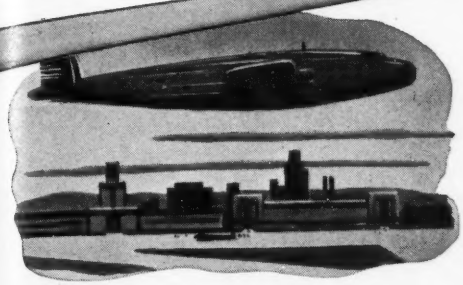
"One Of The Great Clothing Stores Of The State"

SHORT
SHORT
STORY

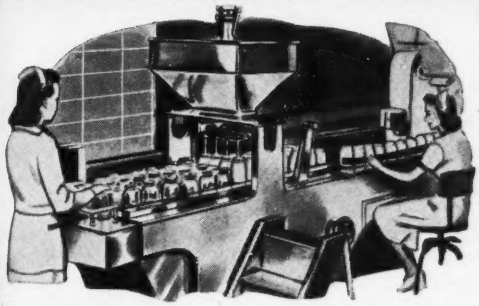
THE proverbial green-as-grass freshman is a thing of the past. Those fellows who come to us for clothes become so well dressed that you can't tell whether they're freshmen or graduate students. It's our long experience in serving university men year after year that keeps us a foremost student fashion center. Whether you're just beginning or just finishing at Cornell, this should be your starting point for the college year. Select yours from one of the largest and finest university clothing stocks in the country.

THE
SPORT SHOP

Filling Prescriptions with Steel!



1. BETTER STEELS! This country needs aircraft that fly high and far . . . and hit hard. It needs ships in great numbers. It needs tanks that can take it when the going gets tough. It needs equipment to outperform any on earth. All these things require many special steels. Such steels with needed properties are created through the use of *alloys*. Basic peacetime research by ELECTRO METALLURGICAL COMPANY, a Unit of UCC, has developed many important steels and the alloys to make them, such as chromium, silicon, manganese, vanadium, tungsten, calcium, and columbium . . . all vital today.



2. STAINLESS STEELS! The development of steels of high chromium content gave designers and engineers a whole family of new materials with which to work. Such steels resist rust and corrosion, and are easily kept clean. They are essential in the food industry. Possessing great strength in addition to their corrosion resistance, they save weight in trains and planes. They have brought improvements in the oil, chemical, textile, and other fields...with resultant savings to you. Low-carbon ferrochromium, an Electromet development, is essential in the large-scale production of stainless steels.

3. NEW NATIONAL RESOURCES! Tungsten and vanadium are essential to steelmakers. Long before war clouds loomed, many felt that more of this country's domestic sources of these metals should be developed. Engineering research by UNITED STATES VANADIUM CORPORATION, another UCC Unit, found efficient ways of refining low-grade ores. This enabled U. S. VANADIUM to revitalize old mines with new mills and methods, and make America less dependent on foreign sources for her increased needs of tungsten and vanadium.

4. BUILDING TOWARDS THE FUTURE! Alloy steels offer still greater promise for the future. Bridges and other structures will be made still lighter, stronger, and longer-lasting by wider use of some of the steels with which engineers are already experienced. Trains, trucks, and aircraft will be made lighter, stronger, faster, and safer. Better cars and tractors, homes and home equipment will be made through their use.

Units of UCC do not make steel. They do make ferro-alloys used to purify and give special properties to steel. They also make nonferrous alloys which, because of their exceptional resistance to wear, heat, and corrosion, are used as cutting tools, hard-facing welding rods, and for other purposes. UCC research and developments mean ever-new and improved alloys for industry . . . and ever-better products for you.

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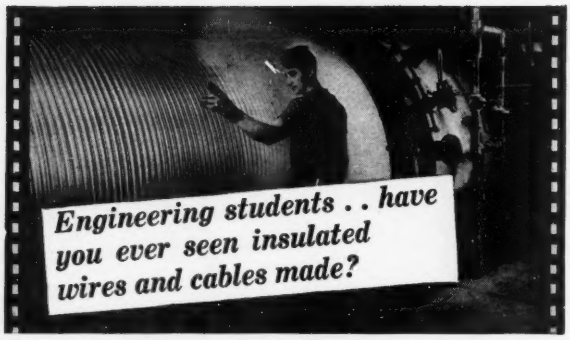
INDUSTRIAL GASES AND CARBIDE
The Linde Air Products Company
The Oxweld Railroad Service Company
The Prest-O-Lite Company, Inc.

PLASTICS
Bakelite Corporation
Plastics Division of Carbide and Carbon Chemicals Corporation



3303

It isn't necessary to visit a manufacturing plant to see how they are made and installed. The Okonite Company has motion pictures available, which we will be glad to furnish without charge at the request of any responsible organization. For instance:

"Rubber Insulated Cables" – Sound film, showing the manufacture of rubber insulated wires and cables from the raw material to the finished product. Narrator: Lowell Thomas. Projection time: 25 minutes. In 16 mm. and 35 mm. sizes.

You can arrange to have this picture for your next meeting by writing to:

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Alumni News

(*Continued from page* 15)

fred Stalfort '34 is project manager.

Grumman Aircraft Corp. at Bethpage, Long Island, received its fourth "E" for continued excellence in aircraft production. The company is headed by two Cornellians, LeRoy R. Grumman '16, president and Leon Swirbul '20, vice-president.

The Army-Navy "E" for excellence in war production has been awarded to the Metal Specialty Company of Cincinnati, Ohio and Richmond, Indiana. H. S. Johnson '11 is vice-president and general manager of the company.

The Raytheon Manufacturing Co. of Newton and Waltham, Massachusetts, of which David T. Schultz '18 is vice-president and treasurer, has received four stars for each of the four divisions of the company which first won the award six months ago.

Sack Discusses Supersonics

Dr. Henri S. Sack, research associate in the College of Engineering at Cornell, addressed a joint meeting of the Rochester sections of the American Institute of Electrical Engineers, the Institute of Radio Engineers, and the Rochester Engineering Society, in the Sagamore Hotel at Rochester on December 2, 1943.

His talk on "Supersonics and Its Applications," was accompanied by demonstrations of supersonic effects, particularly in the field of optics, in which he was assisted by R. N. Work of Cornell.

The speaker is a graduate of the Federal Institute of Technology at Zurich, Switzerland, where he also received his doctor's degree. He has done research work in supersonics, properties of dielectrics, and infra-red radiation, and consulting work on the applications of supersonic waves and on the development of production devices based on dielectric and infra-red phenomena.

Ship Named For Cornellian

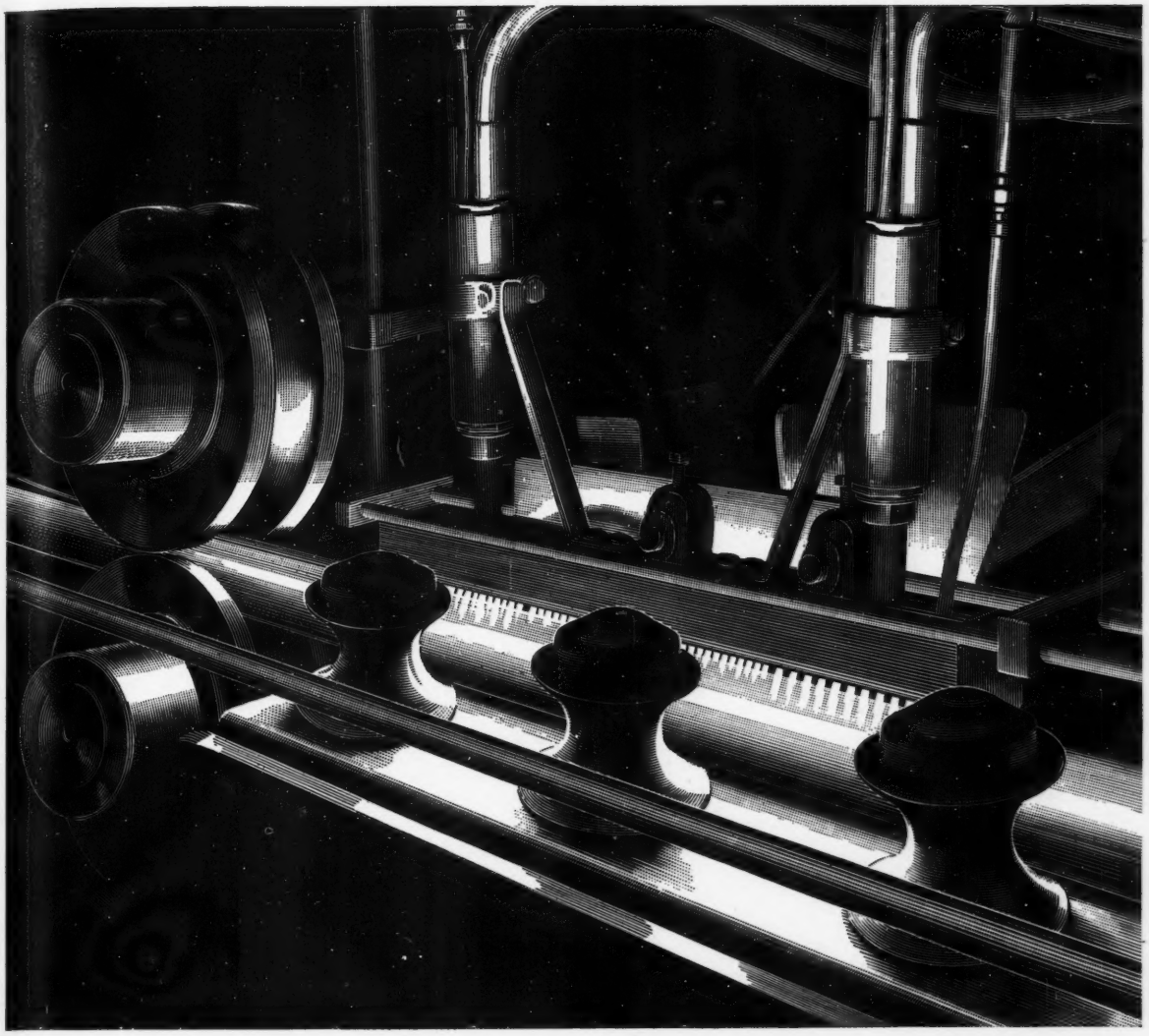
A Liberty Ship has been named for Ross Marvin, Elmira native and Cornell graduate and faculty member who, at the age of 29, was drowned in the Arctic Ocean, April 10, 1909, while on the second Peary polar expedition.

The vessel was launched late last month at the Bethlehem-Fairfield Yard in Baltimore, Md. The name was chosen by John M. Carmody, commissioner of the U. S. Maritime Commission and chairman of the ship-naming committee, who was a boyhood friend of Marvin's.

Marvin received the A.B. degree from Cornell in 1905, and during his college course studied meteorology and other subjects which later were to prove useful to his career. In 1905-06 he was a member of the Peary Arctic Expedition as meteorologist and also navigator of the *Roosevelt*. He returned to New York on Christmas Day, 1906, with Peary. In 1907 he did graduate work in civil engineering at Cornell, and was appointed instructor in 1908.

The following year Marvin volunteered his services for his final expedition with Peary and got his old place as commander of the relief party bringing supplies from the *Roosevelt* to the explorer on the retreat from the Pole. A re-

(*Continued on page* 28)



MACHINE-WELDING ARTERIES FOR INDUSTRY

RACING under a shower of white-hot oxyacetylene flames at speeds up to 200 feet per minute, formed metal strip is quickly converted into welded tubing.

Tubing produced by this Airco automatic welding method is characterized by strength, shock-resistance, and uniform wall thickness—and especially by its speedy manufacture and low cost.

Because of these advantages, tubing welded by the Airco automatic method has found a wide range of uses in industry . . . from drive shafts in trucks and tanks to its more common role in distributing gas, oil and water in machinery of production and war.

This use of the oxyacetylene flame is another example of how Airco research is extending the benefits of flame and arc processes to many manufacturing operations. By constantly increasing the efficient application of these processes, Airco research has broadened their usefulness to industry.

If you want to keep posted on flame and arc developments, write for a free copy of "Airco in the News." Address Air Reduction, Room 1656, 60 East 42nd Street, New York.

AIR REDUCTION

General Offices:

60 EAST 42nd STREET, NEW YORK, N.Y.

In Texas:
Magnolia-Airco Gas Products Co.
General Offices: HOUSTON, TEXAS

Alumni News

(*Continued from page 26*)

port later reaching this country said he fell into the floes, not far from the Pole, and drowned. His body was never recovered.

Carrier Presents Paper

GEORGE F. Carrier, M.E. '39, instructor in the College of Engineering, has had a paper published in a recent issue of the *Journal of Applied Mechanics*. The paper, entitled "Stress Distributions in Cylindrically Aelotropic Plates," was presented at the National Meeting of Applied Mechanics Division of the American Society of Mechanical Engineers in June 1943. The article deals with a stress theory applicable to parts made of laminated plastics and similar materials whose elastic properties are functions of their orientation.

Arthur W. Mellen, Jr.

ARTHUR W. Mellen, Jr., of Scarsdale, captain of the 1917 Cornell baseball team and an insurance official in later life, died recently in Bronxville, at the age of 46, after a long illness. He was assistant treasurer of the Metropolitan Life Insurance Co.

Mr. Mellen received a civil engineering degree from Cornell in 1917 where he was president of Zeta Psi fraternity and a member of Tau Beta Pi, national honorary scholastic society in engineering. In the first World War he received the rank of lieutenant in the Naval Aviation Corps after a course at the Massachusetts Institute of Technology. He belonged to the New York Athletic Club.

Koo in CNAF

LEN Chang Koo, M. E. '40, formerly an employee of the Beechcraft Airplane Co. at Wichita, Kansas, is now an engineer in the Chinese National Air Force. While a student here he was elected to Tau Beta Pi and Quill and Dagger. Among his other activities were the Model League and the Cosmopolitan Club, of which he was president.

Cadettes

(*Continued from page 24*)

course will report in Buffalo after Christmas to work in the engineering department of the Curtiss Wright plant.

Guest speaker at the commencement exercises was C. Wilson Cole, director of training of the Wright Aeronautical Corporation. Other speakers were Mr. Alec Noble, the engineering manager of the Curtiss Wright Airplane Division in Buffalo, and Miss Isabel Lion, supervisor of the cadettes here on campus. Dean S. C. Hollister of the Engineering College was chairman of the program and issued completion of work certificates to the cadettes.

Cadettes successfully completing the course received college credit equal to slightly more than a year's work in the engineering school. Certificates of honor were awarded to the five girls who had the highest standing among the cadettes. Those who received these awards were Ethelyn Cantrell of Atlanta, Georgia; Sylvia Johnson of Albany, N. Y.; Corinne Palmerton of Buf-

(*Continued on page 30*)

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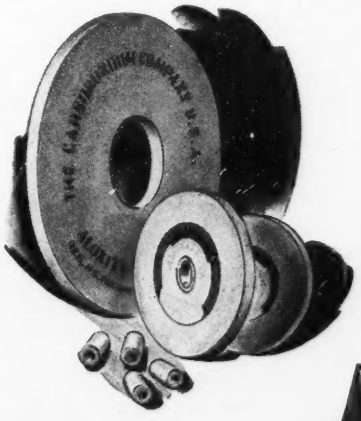

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Cadettes

(*Continued from page 28*)

falo, N. Y.; Helen Putman of Canton, Illinois; and Shirley Relson of Brooklyn, N. Y.

Since Cornell will not be able to sponsor another Curtiss Wright program because of lack of housing facilities, this graduation brought to a close the novelty of having so many girls on the engineering campus.

AIChE

At a recent meeting in Olin Hall the American Institute of Chemical Engineers elected officers for this term. Harold Wood was elected president. Other officers elected were: Charles Holmes, vice-president, and Bryce MacDonald, secretary-treasurer. Two representatives of the Texas Oil Co. were guest speakers. They spoke on "Employment Opportunities in the Oil Industry."

Graduate Employment

The following list indicates the placement after graduation of the Class of '43. Unless otherwise noted, these men graduated in May, 1943. About 40 per cent have civilian positions; almost all the rest are in the armed services.

ADMINISTRATIVE ENGINEERS

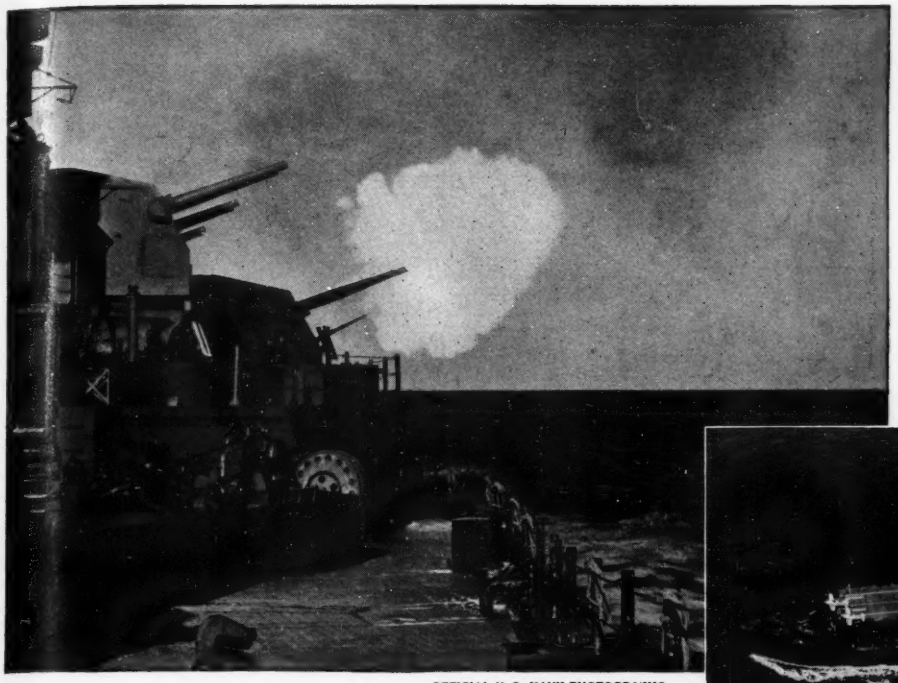
Allen, H. C.	U. S. A. Ordnance
Anderson, Fred	U. S. A. Field Artillery
Baer, J. W.*	U. S. A. Signal Corps
Berger, J. W., Jr.	U.S.N.R. Ensign
Bergrun, N. R.	Douglas Aircraft Co., Inc.
Bernard, H. F.	U.S. Army
Bradt, M. B., Jr.*	U.S. Army
Bruderlin, E. B.*	U.S. Army
Bucher, W. W.	U.S. Army
Clar :, A. J., Jr.*	Ranger Aircraft Co.
Colbert, C. A.	U.S.A. Field Artillery
Coons, D. J.	U.S.A. Ordnance
Dall, J. J.	U.S.A. Field Artillery
Dickhart, W W., III	U.S. Army
Eddy, A. B.*	U.S.A. Ordnance
Fairbank, R. J.	U.S. Army
Fernandez-Gomez, F.	Cuba Sugar Mill
Flint, C. W.	U.S. Army
Forsythe, Clellan F.†	Army Air Corps
Fraser, W. A. B.	U.S.N.R. Ensign
Gilmartin, D. T., III	U.S.N.R. Ensign
Glass, Alexander*	U.S.A. Ordnace
Good, Robert V., Jr.	U.S.N.R. Ordnance
Goodyear, C. H.	U.S.A. Field Artillery
Green, Van Rensselaer H., Jr.,	U.S.A. Field Artillery
Griffith, R. D.*	E.E.C.
Melmic :, L. G., Jr.	U.S.A. Ordnance
Henderson, R. F.	Naval Ordnance
Hudson, J. H.*	U.S.A. Signal Corps
Iliff, C. C.	Allegheny Ludlum Steel Corp.
Johnson, P. V.	U.S.N.R. V-7
Johnson, R. V.,	U.S.A. Ordnance
Kandiko, J. C., Jr.*	General Electric Co.
Keats, J. E.	U.S.A. Ordnance
Ketcham, J. P.	U.S.N.R. Ensign
Krakauer, E. G.	U.S.N.R. Ordance
Krehbiel, R. C., Jr.	U.S.A. Field Artillery
Kulks, J. M.	Sperry Gyroscope
Lamp, C. W.*	U.S. Army
Levy, S. W.	United Transformer Co.
Ludwig, E. E., Jr.	U.S.A. Field Artillery
McCann, R. F., Jr.	U.S.A. Ordnance
Mabbs, E. C.	U.S.A. Field Artillery
Mallen, Philip, III*	U.S.N.R.
Marchev, G. B.	U.S.A. Field Artillery
Mitchell, E. J.	U.S.A. Field Artillery
Murphy, R. B.	Pratt & Whitney Aircraft
Pope, B. A.*	Army Air Corps
Rice, J. D.	U.S.A. Ordnance
Rice, R. L. M.	Chance Vought Aircraft Co.
Richards, J. T.	Army Air Corps
Schrader, H. W.	Consolidated Aircraft Corp.
Schwarz, R. C., Jr.*	U.S. Army
Slater, J. E., Jr.	U.S.A. Field Artillery
Smallridge, B. E.*	Eastman Kodak Co.
South, Furman, III	U.S.A. Ordnance
Sowdon, J. D.	U.S.A. Signal Corps
Steenburgh, R. C.*	Loc heed Aircraft Corp.
Stocking, J. W.*	Bethlehem Steel Corp.
Sundheim, P. J., Jr.	U.S.A. Signal Corps
Swanson, J. R., Jr.	U.S.A. Field Artillery
Turk, T. G.	U.S.N.R.
Whipple, C. J., Jr.*	U.S.A. Field Artillery
Wu, Carl Ching-te	Carboloy Company
Zayas, Francisco*	Returned to Cuba

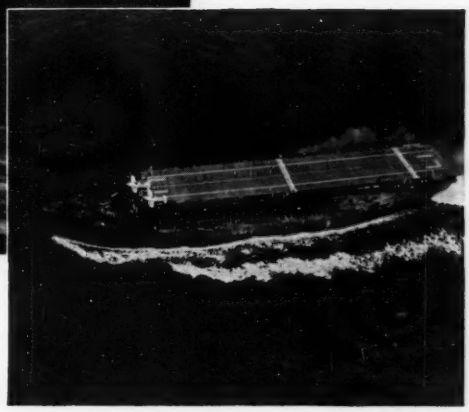
*—February, 1943 graduate
†—September, 1942 graduate

CHEMICAL ENGINEERS

Beecher, J. L.	National Aniline Division
Beh, Bruce*	U.S. Army
Boyd, A. W.	U.S.A. Field Artillery
Caldwell, D. L.	Socony-Vacuum Oil Co.
Cole, I. A.	Atlantic Refining Company
Davison, J. M.	Carbide and Carbon Chemicals Corp.
Deady, R. J.	Standard Oil Co. of Calif.
Edmunds, R. T.	U.S.A. Ordnance
Eustis, R. W.*	U.S. Army
Fritz, R. J.	Standard Oil Co. of N. J.
Kiddoo, Gordon	Chicago Corporation
Klopp, R. P.*	U.S. Army
Kruse, W. N.	U.S.A. Ordnance
Lewis, E. D.	(Not known)
Mead, L. W.	U.S.A. Chemical Warfare Research
Morgan, R. H.	B. F. Goodrich Company
Moore, W. F.*	U.S. Army
Nelles, J. D.	B. F. Goodrich Company
Pastorelle, M.C.	National Aniline Division
Permar, P. H. E. I.	duPont de Nemours & Co.
Powers, J. R.	B. F. Goodrich Company
Roth, E. R.	Dow Chemical Company
Schumacher, F. H.	E. I. duPont d eNemours & Co.
Seaver, P. H.	E. B. Badger & Son
Sfat, M. R.	Federal Nutrition Laboratory, Cornell University
Silcox, F. W., Jr.	Atlantic Refining Co.
Smith, F. C.	Standard Oil Co. of Indiana
Spafford, A. L.*	U.S. Army
Thompson, L. B.	U.S. Government
Tilley, W. H.	Standard Oil Co. of Calif.

(*Continued on page 33*)





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As with most other plants, Busch-Sulzer found it no easy matter to throw its peacetime procedure by the board overnight and get into a full stride of war production. The Navy wanted ammunition hoists above all and quickly. Men, machines and tools had to start from scratch. New men had to be trained. Obstacle after obstacle had to be overcome.

Sooner than we hoped for, the ammunition hoists began leaving our plant. The Navy wanted Diesels and got them, too. The Department awarded Busch-Sulzer its E—and then a star, a second star and now a third.

Now, these official U. S. Navy photographs show what the headaches have helped to accomplish. The 'flat top' is the U. S. S. Long Island, an auxiliary aircraft escort vessel of the type that has been much in the news lately. It is powered by Busch-Sulzer Diesels. The other picture shows the 5″/38s of a battleship being fired. These dual-purpose guns are served by ammunition hoists of the type made by Busch-Sulzer. The hoists are made with watch-like precision. Just what they do for the gun is one of those stories that will astonish you after the war.

Right now it's good to know that skilled American workmen have done and are doing their share to hasten the hour of victory.

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Cornell and V-12

(*Continued from page 6*)

search program of the College is limited. Vital government war research is in progress, and staff members are providing invaluable technical assistance to the war-effort in this way. In the field of non-restricted research there is time for only the more fundamental variety, closely related to post-war problems of far-reaching importance.

The Naval Training Station at Cornell University, with its assignment of student-officer trainees and V-12 apprentice-seamen, has as its commanding officer Captain B. W. Chippendale. A large part of any success which the University may attain in its instruction of V-12 students is due to the able and understanding support which Captain Chippendale and his staff have given to the University in its effort to do a first-class job. The singleness of purpose and mutual understanding which exist between the respective staffs of the University and Naval Training Station are a continual source of pleasure as well as strength. We are, in Navy parlance, a "happy ship."

Mines

(*Continued from page 11*)

met in underground work deal with light troubles. Nowadays these difficulties have been almost done away with by the use of electric lights, improved transits, and new, easy to read rods.

Gas pockets in passages still take their toll of lives, however, although this problem, too, has been partially met by improved safety precautions.

Another difficulty has to do with the relocating of old station marks. These marks are very easily lost in the excessive dust and slime of coal mines. Each surveyor carefully marks each peg he puts in so the job of relocating them is simplified.

The job of surveying a mine lasts as long as the mine is open, as new work is constantly being started as old veins are depleted of their ore. Blue prints of the mine are usually made each month, although different states have different laws, to show changes that have taken place, and photographs also are made every so often which modify the drawings.

In these war days, larger amounts than ever before of coal, iron, copper and other metals are being taken out of mines and put to use. The job of mine surveying, therefore, is now more important than ever, and today forms an interesting and vital branch of civil engineering.

Loose Juice

(*Continued from page 12*)

to a game of football. This seems to return their emotions to a somewhat normal state, and the architect, altruistic soul that he is, takes pity and condescends to lend a hand. This pacifying of the C.E. comes only after they accumulate a large number which they call a score. The architect who realizes that one of the Little Creatures might injure himself and not be able to hop and play with the other fellows, magnamiously gives them their score.

After they have this score they go running back into Lincoln, and little is seen of them for quite some time. For several weeks the architect meditates over this animal psychology, and learns much about the wonders of nature including the birds and the bees and the inevitable Little Creatures.

—*Tony Morrow,* Arch '45

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Graduates Employment

(*Continued from page* 30)

Ullrich, R. D. — U.S. Army
Westberg, J. E.* — U.S. Army
Zabel, R. P. — Tennessee Eastman Corp.

*—Received B.S. in Ch.E at the end of four years instead of a B.Ch.E. at the end of five years.

CIVIL ENGINEERS

Aisenberg, B. P.* — Brewster Aeronautical Company
Arias, Alvaro* — Back to South America
Atesh, Tevfik† — Grad. Student, Syracuse U.
Baskous, Athan — U.S. Army
Belt, D. H. — U.S.N.R. V-7
Bronkie, R. T. — U.S.N.R.
Brown, H. E. — U.S.N.R. V-7
Bundy, D. L.† — Army Air Corps
Cohen, Jerry* — Lockheed Aircraft Co.
Concors, A. F.* — Douglas Aircraft Co.
Correll, W. B. — U.S.N.R. F-V(P)
Dobson, A. A.† — U.S.N.R. C.E.C.
Filby, E. F. — U.S.A. Field Artillery
Findlay, R. C.* — U.S.N.R.
Godley, A. P. — U.S.N.R.
Gustafson, H. A.* — Standard Oil Co. of Ohio
Harrow, T. T., Jr.* — Curtiss Wright Corp.
Hewett, R. W.* — Armed Services
Hickman, R. E. — U.S.N.R. Ensign
Hildabrand, T. J.* — Dravo Corporation
Hoag, N. F.* — U.S. Army Field Artillery
Holden, J. I. — U.S.A. Engineer Corps
Keretli, A. K.† — Grad. Student, Syracuse U.
Kopczynski, A. J.* — U.S.A. Engineer Corps
MacCallum, R. C. — U.S. Army
Machin, E. C., Jr. — U.S.N.R. V-7
Marquart, Otto* — Panama Canal Zone, Special Engineering Division
Milhan, D. W. — Standard Oil Co. of Louisiana
Miller, E. A.* — Grad. Student, Cornell U.
Muedn, George** — U. S. Army
Nelson, R. L. — U.S.A. Engineer Corps
Nobis, T. O. — Greeley & Hansen
Palms, J. C. — U.S.A. Field Artillery
Rupley, G. M.** — U. S. Engineers
Segal, S. J. — U.S.A. Engineer Corps
Shoemaker, C. C.** — Midvale Steel Co.
Steele, R. D. — U.S. Army
Teetor, S. D. — U.S.N.R. Ensign
Thalman, Walter* — U.S. Army
Tugal, Muzaffer† — Grad. Student, Syracuse U.
Tunnicliff, J. E. — U.S.A. Engineer Corps
Wright, D. L.† — Army Air Corps

†—graduated September, 1942
*—graduated February, 1943
**—received degree during 1943, but was not in residence during 1942-43.

ELECTRICAL ENGINEERS

Brodzinsky, Albert† — Radar Research Washington, D. C.
Clement, R. R. — U.S.N.R. O-V(P)
Faulkner, F. K. — U.S.N.R. E-V(P)
Graham, B. W. — Naval Research Laboratory
Holmes, D. B. — U.S.N.R. Ensign
Hughes, R. W. — U.S.A. Signal Corps
Hutton, R. E. — U.S.N.R. E-V(P)
Johnson, D. L. — U.S. Army Signal Corps
Just, George — Navy
Kemon, S. B. — U.S. Coast Guard Reserve
Moore, W. J. — Radio Corporation of America
Morrison, C. G. — U.S.A. Signal Corps
Nairn, J. B.* — U.S.N.R.
Pohl, R. V. — General Electric Company
Ryder, Edson* — U.S.N.R.
Sailor, R. W., Jr. — U.S.A. Signal Corps
Schrader, L. W., Jr. — Western Electric Co.
Totah, E. J. — Communications Testing Lab.
Walton, C. A. — Westinghouse Electric & Mfg. Company
Wheeler, D. B. — General Electric Company
Whitney, D. B. — General Electric Company
Winokur, Peter, Jr. — U.S.A. Signal Corps

*—indicates A.E. in E.E.
†—indicates September, 1942 graduate

MECHANICAL ENGINEERS

Abelson, A. D. — U.S.A. Signal Corps
Adee, T. C. — (Not known)
Binder, A. F.* — U.S.N.R. E-V(S)
Broglie, P. J. J. — Westinghouse Electric & Mfg. Co.
Brown, S. L., Jr. — U.S.N.R. A-V(P)
Candler, W. J. — U.S.N.R.
Chamberlain, R. S. — General Electric Co.
Chase, J. B. — (Not known)
Critchlow, G. F. — Bell Telephone Lab.
Dean, W. S. — U.S.N.R. V-7
Dedlow, R. P. — U.S.A. Engineer Corps
Donnally, Fitzhugh — Republic Aviation Corporation
Dusinberre, R. G. — American Locomotive Co. Diesel Branch
Egbert, P. T., Jr. — U.S.N.R. E-V(S)
Eppler, J. H. — U.S. Army
Flack, Robert — U.S.A. Signal Corps
Gill, A. A., Jr.* — U.S.A. Infantry
Haentjens, W. D. — U.S.A. Ordnance
Harper, J. F. — Carl L. Norden, Inc.
Hodges, J. T. — U.S.A. Ordnance
Holt, S. G. — U.S.N.R. V-7
Junge, Richard — U.S.A. Ordnance
LaCroix, A. J. — Northeastern Airlines
Lewis, F. H. — Bendix Aviation Corp.
Lockwood, G. H. — Landis Tool Company
Loughridge, C. H., Jr. — U.S.A. Signal Corps
Luce, P. E. — U.S.N.R. V-7
McDougal, J. A. — U.S.A. Field Artillery
McGlaughlin, G. W. — U.S.N.R. V-7
McLaughlin, W. E. — U.S.A. Ordnance
Matteson, B. H., Jr.* — U.S.N.R. V-5 (Air Corps)
Miller, R. P. — U.S.A. Ordnance
Morewood, W. H. — U.S.N.R. E-V(P)
Morse, T. K.* — U.S.A. Field Artillery
O'Brien, J. C. — U.S.A. Air Corps Maintenance
Peelle, L. W.* — Remington Arms Co.
Perry, R. W.* — Niacet Chemicals Co.
Pierce, L. J.* — General Electric Company
Pierce, W. B.* — Brewster Aeronautical Co.
Pierpoline, Mario* — Westinghouse Electric & Mfg. Co.
Prisch, R. A. — Pratt & Whitney Aircraft
Ryon, R. C. — B. F. Goodrich Co.
Salt, A. J. — General Electric Company
Seeley, W. R. — U.S.A. Field Artillery
Sens, William* — Wright Aeronautical Co.
Sipperly, Harold — U.S.A. Ordnance
Specht, H. M. — U.S. Army
Stewart, R. W.* — U.S.N.R.
Sullivan, A. D. — Carrier Corporation
Spransy, C. H. — (Not known)
Swallow, G. L. — Carl L. Norden, Inc.
Underwood, R. H. — U.S.A. Ordnance
Ward, D. A. — Dravo Corporation
Warren, R. E. — U.S.A. Field Artillery
Wells, R. C. — General Electric Company
Wilson, James — Pratt & Whitney Aircraft Co.
Worn, G. A., Jr. — Brewster Aeronautical Co.

*—graduated in February, 1943.

Centrifugal Pumps

(*Continued from page 9*)

difficult case occurs whenever the pump has to handle a very light liquid at more than a hundred pounds internal pump pressure. Then there are about four other packing-box arrangements which are possible, the choice among them depending on the type of refinery process involved.

For instance, bleeding out a few gallons per minute through a pressure-reducing device and connecttion at the inner end of the box is an excellent way of eliminating high pressure on the packing, provided that there is available in the plant a vessel at low pressure to receive the liquid (and resulting gas) bled out. Likewise, injection of a small quantity of flushing oil through a similar device and connection at the bottom of the box can solve a packing problem wherein the liquid being pumped is very light in density or injurious to the packing. But in this case there will be slight contamination of the liquid handled by the pump, which sometimes precludes the injection method. The other two common methods of arranging the packing boxes for difficult conditions include the use therein of single mechanical seals or double mechanical seals. (By mechanical seal we mean a device through which leakage is prevented by the juxtaposition of hard machined parts, rather than by compression of some softer intermedial substance in the space where fluid would escape.) Single seals are simpler, require less auxiliary piping and equipment, and are coming into wide use. Double seals require the most complicated set of auxiliaries, because of the necessity that a lubricating seal oil be circulated through the boxes at a pressure always exceeding the internal pump pressure which acts at the packing box throat bushing. This pressure is required to keep the inner seal "closed."

Thus cooling and sealing are the functions of the auxiliary piping which is so prevalent around refinery pumps.

Precautions For Maintenance

In modern refineries the flow of the various fluids must be continuous, day and night, for periods of 60 to 100 days. An interruption of one of the principal pumping services can completely upset the plant unit, and may entail costly cleaning and repairs (particularly of heater tubes, which become plugged by coke formation) as well as the even greater loss due to "non-production". For this reason it is common practice to purchase and install spare standby pumps, completely piped up with all necessary auxiliaries, so that they can be substituted for the regular operating pumps on a moments notice. Sometimes these spare pumps are even started automatically. And for hot oil services, both the regular and the spare pump must be equipped with auxiliary "warming lines" to pass a small amount of hot oil through the idle pump, in preparation for a sudden start.

Another precaution sometimes taken on vital pumps which are normally intended to operate motor driven is the provision of a steam turbine coupled in tandem, making such a unit "dual driven". Both drivers rotate with the pump, but the turbine governor is set so that the turbine does not carry any appreciable load unless the speed of the unit drops below normal running speed. Then if an electric power failure should occur the vital pump is kept running automatically by the turbine, at a speed only about 10% slower.

Precautions For Safety

Fire is a hazard in most all industries, but fire in a refinery can be a truly terrible thing by comparison. If any considerable amount of light hydrocarbon liquid should leak out or be accidentally vented from a pump or other piece of refinery equipment, the resulting inflammable gas may mix with air throughout a large area. If ignition occurs, the flash will severely burn anyone in the enveloped area, even though the fire may not remain widespread for more than few seconds duration. Therefore in refinery pumprooms one often finds the motors and electrical equipment made "explosion proof" (having special enclosures for use in Nat'l. Elec. Code's Class I hazardous location) to prevent sparks. There are also smothering type outer glands on pump packing boxes, (sometimes even with hoods and ducts to exhaust any escaping vapors out through the roof), special drainage systems, and steam hoses used for fire prevention as well as for extinguishing. Insulating jackets and lagging are put on most hot pumps, hot pipes, and steam turbines, not only to conserve heat but also to protect personnel.

Flanged connections on refinery pumps must be specially machined to conform to the particular standards governing the piping to which they will join, for reasons of safety as well as convenience. One would think that all pump manufacturers could recognize the importance of modifying their obsolete non-standard flange shapes to conform with accepted new standards. However, it has been the *unwillingness to change* on this point as much as any other, that has prevented many of them from effectively competing in the manufacture of refinery pumps.

Conclusion

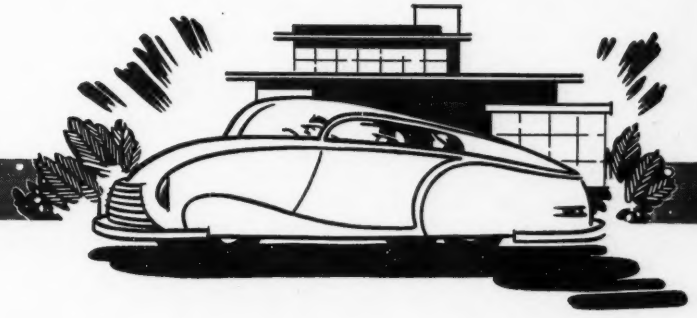
In the books and articles which have been written during the last few years on the subject of pumps, it has seldom been made clear that refinery pumps can be set apart somewhat, as a group. But a glance through the catalogs of certain pump manufacturers who do cover almost all fields of pump application would convince anyone that refinery centrifugals have indeed become a category. So it is hoped that this brief discussion of distinguishing differences will serve to clarify the general picture and enlighten some readers.

Frequent advancements in refining process design and corresponding changes in the pump requirements, plus the endeavor of pump manufacturers to reduce the cost of their product, have resulted in many improvements in only a very few years. There is good reason to suppose that these tendencies will continue, so we should not assume that the present designs are necessarily best. The huge reciprocating plunger pumps and the slow speed, horizontally split, foot-mounted centrifugal pumps of the past have been for the most part replaced by higher speed centrifugal pumps having vertically split casings. From these types may yet come forth even higher speed pumps, smaller and less expensive, to supersede the present models.

To some manufacturers of general service pumps or boilerfeed pumps, the manufacture of refinery centrifugals may have seemed like a "specialty business", of insufficient volume to justify the necessary additional enterprise. Whether they were right or not, there is little doubt but that it is a business that bears watching.

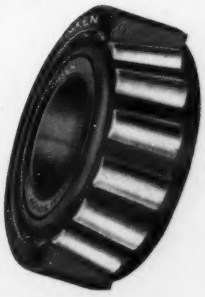
Knowing your Bearings

gets results in WAR and PEACE



MANY of the veteran engineers responsible for the design of the equipment that is winning the war—tanks, trucks, guns, airplanes, etc.—began to acquire their knowledge of Timken Bearings while in college. Now the results are telling on the battle fronts of the world.

When Victory has been won and industry calls you to help in the tremendous job of reconstruction, you'll find a thorough knowledge of the design and application of Timken Bearings one of your most valuable assets. Begin to acquire that knowledge now. The Timken Roller Bearing Company, Canton, Ohio.



TIMKEN

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TAPERED ROLLER BEARINGS

STRESS and STRAIN...

A young gent from Long Island succeeded in evading the draft by convincing the eye doctor that he couldn't see properly ten paces ahead of him. That very night he was seated contendedly in the very last row of the huge Radio City Music Hall, and, to his horror, found the very same eye doctor seated next to him, eyeing him coldly.

The young man thought fast. "Pardon me, doctor," he said with a slight tremor in his voice. "Could you tell me if I am on the right bus for Jamaica?"

* * *

Then there was the ChemE who came to the beer party with a bump on his head. He was putting toilet water on his hair and the lid fell.

* * *

Junk man: Any old beer bottles you want to sell, lady?

Spinster: Do I look as tho I drank beer?

Junk man: Any old vinegar bottles you'd like to sell?

* * *

An ROTC student was trying to enter a movie house at half price. On being asked: "In what arm of the service are you?" he replied, pointing to his cap insignia: "The flame throwers." He was admitted.

* * *

A doctor had an urgent call from a gentleman stating his son had swallowed his fountain pen.

"All right! I'll come at once," replied the doctor. "What are you doing in the meanwhile?"

Came the unexpected reply: "Using a pencil."

* * *

When the flood was over and Noah had freed all the animals, he returned to the ark to make sure that all had left.

He found two snakes in the corner, weeping.

"What's the matter," Noah asked.

The snakes replied: "You told us to go forth and multiply upon the earth, and we are both adders."

An insurance salesman tells about a valuable wardrobe that his firm insured for a client during a European trip. Upon reaching London, she wired: "Gown lifted in London." After due deliberation, he sent the reply: "What do you think our policy covers?"

* * *

Said the visiting prof.: "Your engineers are very intelligent. Are the women here apt, too?"

"Yes, given half the chance, they are apt to."

* * *

Delighted daddy: "What'll we call it?"

Modern mother: "Quits!"

* * *

Clerk: "Shopping bags?"

Three of 'em: "No, we're just looking."

* * *

A parrot was sitting in the salon of a luxurious steamer watching a magician do tricks. The magician served notice that he was going to do a trick that had never before been accomplished. He pulled up his sleeves and proceeded to make a few fancy motions. Just at that moment, the ship's boilers blew up, demolishing the ship. About five minutes later, as the parrot came to, floating about the ocean on a piece of debris, he muttered, "Damned clever, damned clever."

* * *

When you see a lady go
Slim and supple as a doe
Wearing satin cut to fit
As if madame were poured in it;
When you almost lose your mind
Notice how it clings behind
And notice how the curves before
Invite attention more and more;
When thus you stand, romantic, mad,
Take your warning from an ad:
Be sure this vision that you see
Is not the work of corsetrie.
Be sure that all these curves are truly
Acts of God and not unduly
Brought about by man's worst foe,
That two-way stretching so and so.

First Small Boy: "See that little girl over there? Her neck's dirty."

Second Small Boy: "Her does?"

* * *

The belle of the village had just been awarded a loving cup as the winner of the popularity contest. The presentation was made by the mayor, who was a wisecracking old rascal, and, with a wink at the crowd, he asked what made her so popular with all the boys.

The shy beauty considered the question for a few moments and then smiled coyly. "I give up," she said.

* * *

A couple were sitting on the lawn admiring the scenic beauties.

"Some moon out tonight," said he.

"Some stars," said she.

"Some dew on the grass," said he.

"Hell, no! Not me," said she—and left.

* * *

"Are you the Bull of the Campus?"

"That's me, baby."

"Moo."

* * *

Barber: "Was your tie red when you came in?"

Customer: "No, it wasn't."

Barber: "Gosh!"

* * *

A young officer got a ten day furlough to go on his honeymoon. On the ninth day he sent a telegram to his commanding officer:

"It is wonderful here. Requesting ten days extension of leave."

His commanding officer replied: "It is wonderful anywhere. Return to camp."

* * *

"Oh, John," sobbed the terrified wife, "when I was taking my bath, a ghost came out of the closet."

"It did!" gasped the husband, "How did it look?"

"As hard as it could," she answered.

* * *

"This one is on the house," said the seagull as it turned back towards shore.